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Compensation Acts and the Utilities

New workingmen's compensation acts in various states are creating new problems for utility companies. A recent instance of the truth of this statement comes from California, where an employee who was required to inspect gas meters and to turn on and turn off gas was injured on his way home because of being run into by an automobile. The insurance company refused compensation, but the Industrial Accident Commission held that, from its character, the man's employment was continuous and that he was at all times, except when at home, under the protection of the workingmen's compensation act. It should, perhaps, be added that the man's duties were such that at any time when he observed customers moving in or out of houses he was supposed to stop and look after the company's and the consumers' interests. The increased cost of doing business and the new liabilities that are created under recent compensation acts deserve very careful attention by all utility companies in states where these acts have recently been adopted.

Mr. Insull on Regulation

Mr. Insull's far-sighted optimistic views as to the electrical future are not less fascinating because he has expressed them before. They lose none of their interest in repetition. Instead, they gain added importance because of the added conviction which experience brings. His address on the centralization of energy supply, made before the Young Men's Christian Association in New York this week, was designed to acquaint the public with an important phase of electrical development—the economy of monopoly—but it also provided material for the thoughtful consideration of the industry at large. Because of the prominence of the public service commission issue the ideas expressed in regard to regulation are of leading importance, and for the moment they merit more attention than the encouraging technical outlook upon monopoly in energy supply on which so great emphasis was placed. They are not a grudging acceptance of the policy of commission regulation with monopolistic supply to which the country and most of the states are now irrevocably committed. They are an outspoken acceptance of the wisdom of the policy from the standpoint of all concerned. The electrical industry will do less than its fair part in the great public work of the country if it fails to do its utmost to make regulation a success. Since it might drift to the wrong side of this issue it needs strong guidance to keep it in the ways that will promote wholesome regulation. Such guidance should come from and be supported by the recognized leaders, who have developed and still have in their care large interests that are bound to be affected. These men should speak their views in certain tones and thus help to place the industry in the right attitude. If commission regulation fails, the failure should not arise from the fault of electrical supply industries. Accepting the sound economic doctrine that centralization in production and transmission through monopoly is practicable, reasonable and desirable, from both the public and the corporate standpoint, the industry lacks an argument against sane regulation. There is no middle ground. Wise regulation is the best policy.

Regulation and Education

It is not a new idea for the people to have a part in operating any business on which they depend. The more dependence, the more imperative is regulation—hence the attention to utilities at present. Regulation is not a modern fad; it has centuries of English law back of it. While the public may not have the moral or legal right to fall back on the "agency theory" in order to reconstruct the past, it has ample precedent and authority to invoke it at any time for the future. The community has the right at any time to turn over its facilities to an agent to act for it, and all the agent can ask is, first, a definite contract and, second, a proper regard for the contract by both contractors. A danger lies in the present tendency by many utility men to control or regulate regulation through the courts. Nothing could be more futile. The power to regulate belongs to the legislature, and for convenience the legislature delegates its power to a commission. But the legislature, and therefore the commission, represents the people. It is evident, therefore, that, if they are to be upheld, the courts must finally reflect preponderating public opinion in their decisions, even to the extent of interpreting a written constitution. To obviate the real danger, the people must be educated. Public opinion must be formed and then properly translated into law. Not only for their own private interests, but as a patriotic duty, public utility men must undertake this educational work, which must be done frankly—in the open. Incidentally the teacher will have nearly as much to learn as the pupil. More than all, it must be so done that the public will acquire an increasing amount of respect for the honesty of purpose of the public utility men. When properly carried out regulation is of great benefit to both the utilities and the public, their interest being identical in almost all respects. The necessity and desirability of regulation by commissions having been

established firmly, the problem of the moment is the education of the public and the utilities concerning each other's needs, in order that the commissions may determine what is of greatest benefit for all.

Combination Gas and Electric System

It often falls to the lot of a public utility to combine the distribution of electricity and that of gas. Instances in which an electric company has taken over gas plants are not very frequent. Those of the opposite kind are fairly common, one notable example, of which we furnish some account in the present issue, being the Laclede Gaslight Company of St. Louis. As a gas company it covers the whole city. As an electric company it has a wide area of distribution, but does not cover the entire municipal territory. Were it possible for a great utility to make a fresh start and go into the business of supplying all the gas and electricity in a modern city, some very wonderful economies could unquestionably be carried out, and the result might be made gratifying in the extreme; but there is no example of such practice on any considerable scale. While united gas and electric plants are often operated with great success, they have not yet been able to reap the full advantages of the combination, and the installations can therefore do no more than display a highly commendable amount of skill and ingenuity in the adaptation of means to ends.

The electric service of the Laclede Gaslight Company consists in the main of an up-to-date turbo-generator station of 8000-kw rating. The generators are star-wound, with neutral connection, giving either 2400 volts or 4150 volts and furnishing directly a single-phase distribution for lighting and a three-phase distribution for motor service. It is one of the few stations in which these two distributions are in use independently, a peculiarity probably due to the earlier history of the enterprise and to local conditions. A feature of the generating equipment worth mentioning is the triplicate excitation system. The main generators can be supplied with exciting current from an independent steam turbine and generator, from a motor-generator set, or from a storage battery. Another unusual feature of the system is a considerable 550-volt direct-current motor distribution system in the central part of the city. A large part of the energy for this is furnished by a pair of 500-kw three-bearing motor-generator sets in the main station. The motors used are synchronous machines, so that the best can be made of the necessity of having such sets by utilizing them not only to furnish energy but also to regulate the power-factor. There are two substations for feeding energy for the 550-volt circuits, one with a motor-generator set and the other with a rotary converter having a voltage regulator to assist in controlling the voltage of the direct-current system.

As a part of the same system a very neat special generating station, of a character altogether unique, is installed at the gas works. A battery of engine-driven compressors is used for pumping gas into the extensive high-pressure mains of the company. The steam from these engines exhausts into a low pressure turbine driving a 300-kw generator which is tied solidly to a rotary converter and thus feeds energy into the direct-current network so long as the compressors are in operation, which is for a large part of the day. Incidentally, the electric distribution of the company renders good service in operating the conveying machinery for the gas plant. Taken altogether, the equipment is of a somewhat unusual character, displaying well the art of making the most of the existing circumstances.

Economics and Esthetics

In his presidential address before the American Electrochemical Society Dr. E. F. Roeber discussed in a very fascinating way certain psychological and esthetic aspects of electrochemistry which are of great importance, although they are apt to escape the notice of the multitude. He pointed out that in an age like ours, of machinery and scientific applications, the popular sense of what is beautiful necessarily becomes extended to include things which are mechanically and scientifically beautiful by reason of either their structural relations or their skilful application of fundamental principles to a purpose. The sense of these latter kinds of beauty comes only with a training of the mechanical and physical powers of the mind, just as the sense of beauty in pictorial art comes with a training of the mental perceptions of form, color and artistic design. The new age does not destroy the older types of beauty. It merely adds new types to the list.

The wholly untrained eye sees nothing particularly interesting in the "Mona Lisa." The wholly untrained ear listens not with any languishing to Beethoven's symphonies. The primeval redskin warrior of Fenimore Cooper would only see "big medicine" in the works of an automobile. So, in every art and accomplishment of the wide world, the eye that sees beauty must bring beauty to the vision from within. Not in vain has the poet declared that beauty is in the eye of the gazer. With the ever-increasing complexity of production and manufacture there is a correspondingly increasing multitude of potential opportunities for admiration. No single mind possesses the resources or has ever been dowered with the keys to that knowledge which should perceive all of the countless types of beauty which exist.

Dr. Roeber's address is a plea for the redemption of the Niagara waste. We believe that not only engineers but also a large percentage of the public will support his contention that the legislative restriction of the Niagara Falls as a spectacle, to the detriment of industrial applications, is a waste, a blunder and a sinful extravagance. No one possessing intelligent eyesight can help admiring that great cascade of water. A gigantic waterfall is a majestic sight. If, however, we are all determined to preserve what remains of this

cataract as a moving picture, for perpetual public inspection, twenty-four hours a day, let us admit frankly to ourselves the spectacular extravagance of the decision. As a show-piece it is costing us hundreds of thousands of dollars a day, in the sense that the ultimate selling price of the wasted energy should aggregate such a cost. Every ton of water deflected from the falls means the retention of a corresponding quantity of coal for the needs of a later period. The pressure of economic necessity among a population growing rapidly will finally force the popular will to utilize more and yet more of the available Niagara power. Even then, however, it should be possible to close most of the wheel-pit gates daily for the noon hour, thus restoring the cataract for the visitors' hour. It would at least be more reasonable to grant fresh water rights under such a proviso than to keep back all of the power all of the time.

High-Voltage Plants of the World

We publish this week a chart with descriptive comment gathered by Mr. Selby Haar on the transmission plants throughout the world which operate at exceptionally high voltage. No one who has not attempted some terrific task of this kind can realize in the least the enormous amount of labor required to obtain exact information regarding even a few transmission plants, let alone all which are operated at or above 70,000 volts. The thoroughness with which Mr. Haar has done his work is well attested by the small number of gaps in the table. It is very easy to find the complete details regarding one or two plants, or a portion of them concerning a large number of plants, but to make really thorough an undertaking like that referred to is quite another matter. We congratulate the author on the result of his very searching investigation.

The line between high voltage and extra high voltage was drawn somewhat arbitrarily at 70,000 volts. The primary reason for this is that to include plants at 40,000 to 70,000 volts would enormously complicate the table without leading to particularly valuable conclusions as to high-voltage practice, since many of the systems of less impressive voltage are old and small, and to include them would give an inaccurate idea of the present situation. Moreover, 70,000 volts is about the line at which the pin-type insulator reaches the limit of its usefulness. One cannot pass this figure far without reaching a point where the design of an insulator which will withstand the working voltage in a drizzle becomes extremely difficult. In point of fact, only a few of the plants operating above 70,000 volts are not equipped with suspension insulators. Looking over the table as a whole, it furnishes extremely striking evidence of the progress that has been made. There are thirty-one plants operated at or above 100,000 volts working pressure. All but half a dozen of these are on this continent and most of them in the United States. All but one are three-phase plants, although the criterion adopted of rating the voltage on the working point for which the plant is designed would certainly force the inclusion of the constant direct-current transmission system from Moutiers to Lyons, which at full load goes above the required figure.

As to frequency, about 40 per cent of the total list of plants are operated at sixty cycles, 30 per cent at fifty cycles, and the rest at other periodicities, mostly 25 cycles. There seems to be a strong tendency to use single-phase units in the transformers, although quite a few plants use the three-phase type. As to the connection of these transformers there is no general agreement in practice under these extreme conditions of voltage in spite of much discussion and many learned papers regarding the advantages of one or another connection. Rather more plants use the straight delta connection than any other complete combination, but there are numerous examples also of star connection on the high-tension sides. It is very apparent that none of the objections to either practice carries any great weight.

With respect to line construction, with rare exceptions steel towers are used for this work of the first magnitude, with spans ordinarily running from 500 ft. to 700 ft. In most instances there are two complete circuits per tower, a few plants relying on a single circuit and a few others having duplicate tower lines each with a single circuit. Most of the line conductors are of stranded copper, and the usual spacing between wires is in the vicinity of 10 ft. at voltages over 100,000 and from 6 ft. to 8 ft. below that figure. Without exception the insulators are of the suspension type for all voltages of 100,000 and over, and often for voltages below that limit. Nearly all the plants have overhead ground wires of stranded steel, usually one, rarely two, and in a very few instances three. Except in a few cases, the lines are protected by aluminum lightning arresters, although in some plants use is made of horn arresters of various types and an occasional plant is found without any lightning protection at all.

The arrangement of conductors is worth a word of mention. The earlier practice was almost exclusively in the line of the equilateral triangle arrangement. Experience seems to have shown that the gain from this symmetrical position is not of much practical importance, and in recent tower lines the tendency has been toward a vertical arrangement slightly modified so that the three wires will not be absolutely in line, although in some important systems the wires are run in the same horizontal plane. The general experience throughout seems to have been that with modern construction these extremely high-voltage lines are much easier to operate than would have been deemed possible even a very few years ago. At each upward step in voltage difficulties once feared seem to have retreated before the march of progress. The main question to be asked to-day when a project for transmission over very long distance and at extreme voltage comes up is not, "Can it be successfully done?" but, "When we have done it successfully will it pay?" And the answer generally is, "Yes."

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Hearings on Oldfield Patent Bill

The committee on patents of the House of Representatives had expected to begin hearings at Washington on April 22 on the Oldfield bill revising and amending the laws relating to patents. However, as the House of Representatives was in session that day in order to act on the Mexican resolution, the committee held only a brief meeting and did not hear any testimony on this subject. According to the present plans of the committee, hearings will be started next week.

At its short meeting the committee heard testimony from manufacturers of stoves and stove parts on the Oldfield bill providing for the registration of designs.

A Million a Year Offered for Los Angeles Aqueduct Power

The electric generating companies of Los Angeles, the Southern California Edison Company, the Los Angeles Gas & Electric Corporation and the Pacific Light & Power Corporation have agreed to buy all of the energy generated by the Los Angeles aqueduct power plants. In a formal offer the companies agreed to pay the city a wholesale price to be set by the State Railroad Commission amounting to at least a million dollars. This is with the full understanding that the City Council will protect the people by fixing a low retail rate. As an alternative the companies have offered to enter into a co-operative arrangement with the city for the public use of their complete distributing systems for five years, the city to make all rates, all contracts with consumers, read all meters, handle all money and collect all bills. The companies will receive only the sum determined by the State Railroad Commission as equitable. It is pointed out that either of the offers will materially reduce tax burdens and that co-operation between the city and the companies for five years will greatly improve Los Angeles' financial standing.

Worcester Electric Light Company Progressing

Expansion all along the line is under way on the system of the Worcester (Mass.) Electric Light Company. Construction has begun upon the underground distribution lines for the ornamental magnetite-arc-lamp installation to be completed throughout the business center of the city by early summer, and an enlargement of the Webster Street generating station is being made to house a new 7200-kw turbo-alternator which is required by the rapid increase in the load. A substation is being built at the plant to raise the pressure of the company's tie-line circuits between Webster Street and the Faraday Street and Southbridge Street substations from 2300 volts to 13,200 volts. An important power contract was obtained a few days ago, when the Crompton & Knowles Loom Works, one of the oldest and largest manufacturing plants in the city, decided to shut down their steam plant and purchase energy of the company. The connected load will be about 1600 hp in 550-volt, three-phase induction motors and about 200 kw in lighting apparatus. Thirty motors will be installed at first, and extended studies will be made by the Worcester Electric Light Company leading toward future subdivisions of the power installation. The power engineering department has prepared a monthly log sheet, 15 in. by 28 in. in dimensions, for use in following the daily performance of the Crompton & Knowles installation, including nearly fifty items relating to fuel, weather, temperature, steam pressure, labor, production, repair, electrical and other conditions bearing upon operating economy. The addition of this establishment will bring the connected motor load to 15,600 hp, a gain of about 10 per cent. A 500-hp motor installation has recently superseded a steam-engine drive of many mechanical complications in the factories of the Merrifield estate.

Pittsburgh Holding Company Insures Its Employees

The Philadelphia Company of Pittsburgh has made a group insurance arrangement with the Equitable Life Assurance Society of the United States effective April 1. This is one of the largest insurance transactions ever negotiated, and carries with it life insurance equal to the amount of one year's salary to the employees of the following companies: Philadelphia Company, Philadelphia Company of West Virginia, Pittsburgh & West Virginia Gas Company, Allegheny Heating Company, Equitable Gas Company, Monongahela Natural Gas Company, Consolidated Gas Company of the City of Pittsburgh, and the South Side Gas Company. The cost of insurance is borne entirely by the company and is issued on the group plan. Employees in the service from one to less than two years will be insured for the equivalent of six months' wages, and those in service two years or more for the equivalent of the previous full year's salary.

Mr. J. H. Reed, president of the Philadelphia Company, has fixed a maximum amount of insurance on any one employee at $200 any one month for one year, saying that the company was prompted in the matter of this insurance by desire to protect the families of the rank and file of faithful employees. The Philadelphia Company is a holding company and employs about 5000 persons. Among the properties it controls are the electric light and railway companies in Pittsburgh, Pa.

Pupin A. I. E. E. Lectures

Dr. Michael I. Pupin, professor of electromechanics at Columbia University, will deliver two lectures "On the Relation of the Electromagnetic Theory to the Science of Electrical Engineering of the Present Day" at the Engineering Societies Building, New York, on Wednesday evenings, April 29 and May 6. These lectures will be given under the auspices of the committee on technical lectures of the American Institute of Electrical Engineers. In these lectures Dr. Pupin will show how far electrical science could have developed with-

out Clerk Maxwell's work and along what lines there would have been no development without this work. The recent advances in electrical engineering, including radio-telegraphy and radio-activity, he finds are much more dependent upon Maxwell's work than that type of engineering which may be called heavy-current engineering. The lectures are intended to bring out the points of contact between Maxwell's electromagnetic theory and the ordinary or less broad electromagnetic theory which serves as the foundation of electrical engineering to-day. The meetings will be open to the general engineering public, including non-members as well as members of the Institute.

Educational Conference at N. E. L. A. Headquarters

On April 20, 1914, there was held at the headquarters of the National Electric Light Association a conference for the purpose of promoting closer co-operation between the technical schools and the electric-lighting industry. The conference was called by Mr. John F. Gilchrist, of the committee on relations with educational institutions. To it were invited a number of engineers interested in the practical and the educational side of their profession and the heads of departments of a number of important technical schools. These men composed a committee to consider and apply methods for fostering helpful relations between college committees and leaders in the central-station business.

The meeting was attended by Messrs. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company; L. A. Ferguson, Commonwealth Edison Company; W. W. Freeman, vice-president Cincinnati Gas & Electric Company; C. A. S. Howlett, General Electric Company; J. F. Gilchrist, Commonwealth Edison Company; J. W. Lieb, Jr., New York Edison Company; T. C. Martin, secretary N. E. L. A.; H. H. Norris, *Electrical World;* S. A. Sewall, assistant secretary N. E. L. A.; Paul Spencer, United Gas Improvement Company; Arthur Williams, New York Edison Company; C. Beebe, University of Wisconsin; H. C. Clifford, Harvard University; O. J. Ferguson, University of Nebraska; A. F. Ganz, Stevens Institute of Technology; C. F. Harding, Purdue University; P. M. Lincoln, University of Pittsburgh; C. F. Scott, Yale University, and G. D. Shepardson, University of Minnesota.

The net result of the conference, in addition to promoting a general spirit of co-operation, was the passing of a motion that the work of the committee should be subdivided, each section taking up a special phase of the work in which the members are particularly interested. The sub-committees will be appointed shortly by Chairman Gilchrist.

Progress on Boston "Tech" Buildings

Rapid progress is being made in the construction of the new buildings of the Massachusetts Institute of Technology on the Cambridge side of the Charles River Basin at Boston. About 400 men are now at work on the site, and the force is being steadily increased. Concrete was first poured for foundations on April 9. Three pile-drivers are at work with a capacity of 300 piles per day, and an extensive lumber yard and construction mill equipment are in use. The well of the hydraulic laboratory is practically completed and the aeronautical laboratory is ready for service. An experimental span is being erected for the electrical laboratory for transmission investigations, with two steel towers similar to the Big Creek (Cal.) installation, the span being 500 ft. Thesis work by Institute students is being pushed along civil-engineering lines, including tests of full-size concrete beams. Electrical energy for construction service on the grounds is being supplied by the Cambridge Electric Light Company, a 90-kw transformer installation having been erected for present requirements. The buildings are being erected by the Stone & Webster Engineering Corporation, of Boston.

Annual Report of the General Electric Company

The business of the General Electric Company in the year 1913 exceeded in volume the record of any previous year. The twenty-second annual report, issued to stockholders this week, shows that the value of orders received was $111,819,142. The amount of sales billed was $106,477,439. Profits from the sales were $10,269,605, while the income from other sources amounted to $3,796,184. From the total income of $14,065,789 there were deducted $1,007,910 for interest and discount on debentures and notes payable and $8,149,205 for dividends, or a total of $9,157,115. The balance carried to the surplus account was $4,908,674.

Mr. C. A. Coffin, chairman of the board of directors, says that the tendency toward an increase in the number of orders and a reduction in their average value continued during the year. More than 600,000 orders were received. This feature of the business, together with increased competition, caused an unavoidable addition to the expense of securing and filling orders. The number of employees of the company engaged in factories, offices and subsidiary companies at the close of the year exceeded 65,000. Following the previous practice of the company the expenditures for the purchase of patents, for applications and licenses under patents and for miscellaneous expenses in connection therewith, amounting to $662,925 for the year, were charged to income account and the patent account is still carried at $1. The valuation of $1 represents on the balance sheet "patents, franchises and good-will."

The valuation placed on stocks and bonds owned is $25,964,317, of which $17,574,844 represents stocks of subsidiary companies and $8,389,473 stocks and bonds of public utility and other companies. The current accounts and notes receivable are carried at $26,210,459. Mr. Coffin says that they have been carefully reviewed and conservatively valued, abundant provision having been made for possible losses. The rapid growth of subsidiary companies has required substantial advances during the year to provide additional facilities and for increased working capital. The total amount due from these companies is now $6,817,563, making the aggregate balances of all accounts and notes receivable $33,028,022.

During the year 1,740,000 sq. ft. of additional manufacturing floor space was provided, making a total of 13,900,000 sq. ft. at the close of 1913. Expenditures for additions and improvements to manufacturing plants aggregated $11,373,118, while the amount written off was $6,502,060, making a net increase of $4,871,058. Information in regard to changes in the book value of the plants is furnished. On Jan. 31, 1893, the book value of the Schenectady, Lynn and Harrison plants was $3,958,528. During the twenty-one fiscal years ended Dec. 31, 1913, expenditures were made, including the cost of the Pittsfield, Erie, Fort Wayne, Sprague and National Lamp plants, aggregating $69,314,630, or a total of $73,273,158. During the period of twenty-one years $43,845,990 was written off, leav-

ing the book value of the plants at the close of 1913 at $29,427,168.

The amount of capital stock outstanding on Jan. 1, 1913, was $101,202,000. During the year $20,000 debentures of 1892 and $159,200 debentures of 1907 were converted into stock, making a total issued amount of $101,381,200. Quarterly dividends at the rate of 8 per cent per annum were paid during the year. An issue of $8,000,000 of nine months' notes maturing on April 16, 1914, was sold in July, 1913, at a discount rate of 6¼ per cent per annum for the purpose of meeting demands due to a large increase in business during the first half of the year and other burdens incident to the very unsettled financial conditions existing then. Money was deposited out of current funds for the payment of these notes at maturity. The company has no other notes payable and there is no paper outstanding bearing its indorsement.

In speaking of his election as chairman of the board, Mr. Coffin refers thus to his successor: "Mr. E. W. Rice, Jr., senior vice-president, whose term of service has been of equal length with my own and who has intimate familiarity with the important interests of the company, was elected to the presidency."

PROFIT AND LOSS ACCOUNT

Sales billed			$106,477,438
Less: Cost of sales, including all operating, maintenance and depreciation charges			96,207,833
			$10,269,605
Interest and discount, royalties and sundry profits		$1,478,721	
Income from securities owned		1,281,463	
Increase in value of securities of companies owned, due to additions to the surplus of those companies		1,036,000	
		$3,796,184	
Less:			
Interest on debenture bonds	$576,432		
Balance of discount on debenture bonds issued in 1912	37,438		
Discount and expenses on note issue	394,040	1,007,910	
			2,788,274
			$13,057,879
Dividends paid			8,149,204
Net surplus for the year			$4,908,674
Surplus at Jan. 1, 1913			12,031,145
Surplus at Dec. 31, 1913			$16,939,819

The company's balance sheet shows merchandise inventories of $37,790,738, of which $31,697,055 was at factories, $4,010,538 at district offices, in transit, etc., and $2,083,145 in consignments. Real estate, buildings, warehouses, etc., other than manufacturing plants, amounted to $1,058,386. Furniture and appliances, other than in factories, are carried at $2. Installation work in progress amounts to $2,012,514. The condensed profit and loss account is published herewith.

Marwick, Mitchell, Peat & Company, the chartered accountants who examined the accounts, said in their certificate that the valuations at which the stocks and bonds are carried are conservative and have been approved by a committee of the board of directors. The notes and accounts receivable are shown at their realizable value, due provision having been made for possible losses through bad and doubtful debts. Certified inventories of work in progress, merchandise and materials and supplies have been submitted to the accountants, who have satisfied themselves that the inventories have been taken in a careful manner, that they have been valued at or below cost price, and that full allowance has been made for old or inactive stocks. Provision has also been made for possible allowances or additional expenditures on recently completed contracts and on installation work in progress. The accountants add that all expenditures capitalized in the property and plant accounts during the year were properly so chargeable as representing additions or improvements and that ample provision has been made in the operating accounts for repairs, renewals and depreciation.

Magnetic-Survey Yacht "Carnegie" Has Completed 100,000 Miles

From 1909 to 1913 the Carnegie Institution's ship *Carnegie* traveled 100,000 miles while her staff was engaged in the work of charting the magnetic lines of force and other phenomena of the oceans. Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution, told of the work of this famous non-magnetic vessel at a joint meeting of the American Geographical Society and the Association of American Geographers at New York on April 3.

During her four-year cruise the *Carnegie* has sailed in all the oceans and has traversed a distance equal to seven times the circumnavigation of the globe. During 1914 the ship will begin a cruise in the North Atlantic Ocean, and next year she will pass through the Panama Canal and patrol the South Pacific and South Atlantic.

Dr. Bauer reported that the Carnegie Institution had established about 3000 land stations for taking magnetic observations. These stations range from Greenland on the north to New Zealand on the south, and are established at average intervals of 100 miles.

All materials used in the construction of the observation yacht *Carnegie* are non-magnetic. The vessel is equipped with sails, brigantine-rigged, but has an auxiliary engine built entirely of brass and copper. Under full canvas she can make 300 knots a day. All metal parts of the ship are of bronze or copper so as to produce absolutely no effect on the delicate magnetic measuring instruments. "The cutlery was of Mexican silver," said Dr. Bauer; "the anchors were of heavy bronze; the sailors' sheath knives were of non-magnetic manganese steel, and even the sailors themselves were bronzed."

Uniform Accounts Discussion in Missouri

Considerable apprehension was aroused among the private-company utility men of the State of Missouri, particularly those operating the smaller companies, by the orders of the Missouri Public Service Commission, dated March 9, 1914, in the matter of adopting a uniform system of accounts for electric, gas, water and heating public-service companies, as well as municipalities operating utilities of this description. Every corporation and municipality in the State engaged in these utilities was made a defendant in the proceeding relating to the proposed adoption of the uniform systems of accounts for the utilities enumerated. A public hearing was set for April 15. The Missouri Electric, Gas, Street Railway and Water-Works Association "got busy" at once. A meeting was held in St. Louis April 1. Committees were appointed to consider various aspects of the subject and these reported at an adjourned meeting held in St. Louis on April 14. Following this meeting the reports of the committees, duly adopted and authorized by the association, were laid before the Public Service Commission of the State at the hearing of April 15, which took place in the Senate Chamber of the Capitol at Jefferson City.

The public hearing proved to be a pleasant and harmonious one. All of the members of the Public Service Commission were present except Commissioner Wight-

man. Chairman John M. Atkinson presided and did the talking for the board, the other sitting members being Messrs. William F. Woerner, John Kennish and Howard B. Shaw. Mr. Richard Yates, a member of the State Public Utilities Commission of Illinois, sat with the commission and was an interested spectator of the proceedings. The upshot of the meeting was that Chairman Atkinson expressed himself as much gratified by the co-operation of the utility men and suggested that they appoint a committee to represent them to take up with the commission's department of statistics and accounts various modifications of the schedules which had already been practically agreed to. This committee was appointed, and after it confers with the accounting department of the commission a report is expected.

Photometric Tests of Lamps for Street Lighting

A lawsuit involving the candle-power of gasoline mantle street lamps and the accuracy of photometric measurements has been on trial in Philadelphia recently. The Welsbach Street Lighting Company of America had the contract for operating about 18,000 gasoline mantle street lamps in outlying districts. The contract specifications were peculiar in that they called for "lamps to be tested photometrically as to actual street illuminating power, . . . and the minimum illuminating power they shall be required to furnish on the street at all times, under conditions herein specified, will be 60 cp," and further that "this illuminating power shall be determined by horizontal measurement, at the city's photometric stations or elsewhere," at the discretion of the director of public works, "using any method sanctioned by standard practice." The specifications provided that the test should "be made with the clear glass globe which incloses the lamp on the street removed, but otherwise under the same conditions as exist when the lamp is taken down, the object of the test being to determine that the actual illuminating power as contracted for is given on the street." No less than twenty-five lamps in each of five districts, or 125 lamps in all, were to be tested each month and deductions made from the rate of $29 per lamp a year by whatever percentage the lamps tested for each district averaged below 60 cp.

Soon after the contract was awarded the city authorities found it impracticable to move mantle burners to a laboratory for test. Two plans were adopted for testing lamps during the first six months of 1913. One was to attach a Sharp-Millar photometer to the lamp-post and by means of mirrors to reflect the horizontal candle-power of the lamp into the photometer. These tests were made with lantern globes, and a deduction was made for the loss of light due to the globe by taking 125 lamp globes off the street and testing them at the Drexel Institute. A globe absorption averaging 13.4 per cent was measured by this process, and the readings were corrected by that amount to determine the candle-power with the globes removed. Beginning with March, use was made of a laboratory photometer bar with Lummer-Brodhun head, on an automobile truck, carefully housed in with tarpaulins. After testing each lamp on the post it was very carefully removed from the post while burning and taken into this "floating photometric station," as it was called, and tested both with and without the globe. All of the testing was done by the Electrical Testing Laboratories of New York, with Mr. W. F. Little in charge. The results for the four months during which both methods of test were used averaged as follows:

Sharp-Millar photometer, globe on, 43.9 cp; globe off (by correction of 13.4 per cent), 50 cp.

Laboratory bar instrument, globe on, 43.6 cp; globe off, 50.3 cp.

There were considerable variations above and below averages in the 500 tests covered by these figures, and in many cases the lamps fluctuated badly in candle-power.

On the basis of these tests the city deducted an amount proportional to the shortage in candle-power from the company's charge, amounting in six months to about $53,000. The company brought suit to recover the amount deducted. Early in the trial the judge ruled out the tests with the globes in place as not being according to the contract in spite of the efforts of the city to show that they were the fairest that could be devised under the circumstances. The city then resorted to the tests made with the floating photometer with the globes removed. Expert witnesses on both sides agreed that the photometric bar and head were "sanctioned by standard practice" but that the method of removing from the post to the truck for the test was new.

The company has made much of the possibility that drafts of air might affect the readings of the truck. The city presented the average figures given above, which show little difference between lamps tested on the post and on the truck. The company pointed out the implications in the contract that removal to a laboratory was contemplated and also brought in correspondence to that effect. The case was decided by the jury in favor of the company.

Messrs. C. O. Bond, F. V. Westermaier and Claude W. Jordan, of the United Gas Improvement and Welsbach companies, and Dr. Louis Bell, consulting engineer, appeared as expert witnesses for the company. Messrs. E. C. Crittenden, Bureau of Standards; J. R. Cravath, consulting engineer; Judson C. Dickerman, chief Philadelphia Bureau of Gas; Prof. James A. Evans, Pennsylvania Department of Agriculture; Prof. H. S. Hower, Carnegie Institute of Technology; Professor Hoadley, Swarthmore College; Charles F. Lacombe, New York City; Prof. H. J. Rowland, Drexel Institute, and A. H. Taylor, Bureau of Standards, as witnesses, with Prof. J. M. Bryant, University of Illinois, and Prof. A. H. White, University of Michigan, in a consulting capacity, constituted the city's array of experts in the case.

Suggestions to Congress Regarding Trust Legislation

A letter addressed by Mr. Wade H. Ellis to Chairman Adamson of the committee on interstate and foreign commerce of the House of Representatives in regard to pending trust legislation has been made public by the committee. The letter suggests a change in phraseology of the trades relations bill. It is suggested that the form used in a decree entered in October, 1911, in the case of the United States vs. the General Electric Company in the Circuit Court of the United States for the Northern District of Ohio, Eastern Division, be employed. Mr. Wade conducted this case for the government.

In conformity with the general principle of this decree, the following is suggested by Mr. Wade for inclusion in the trade relations bill to cover price restrictions: "It shall be deemed an attempt to monopolize trade or commerce among the several states or with foreign nations or a part thereof for any person selling goods in interstate or foreign commerce to offer or make more favorable prices or terms of sale in such commerce to the customer of any competitor than such person shall at the same time offer or make to his established trade where the purpose or intent is to injure

or destroy such competitor; provided, that it shall not be unlawful for any person selling goods in interstate or foreign commerce to make or offer any price or terms of sale in order to meet or compete with any price or terms previously made by any competitor, whether such competitor is or is not selling in interstate or foreign commerce."

Another Tax on Canadian Central Stations

The present political party in power in the Province of Ontario, Canada, recently found it necessary to secure additional income with which to carry on the government. The method adopted was to increase the tax on various corporations such as insurance companies, banks, gas and electric companies, etc. The authority requisite for the imposition and collection of the increased tax is contained in Bill No. 169, of 1914, entitled "An Act to Amend the Corporation Tax Act." This bill has gone to a second reading, and, as it is a party measure and as the Ontario Parliament will adjourn in a very few days, it is almost a foregone conclusion that the bill will become a law.

The section of Bill No. 169 which is of interest to the privately owned central stations in Ontario is No. 11, under the sub-title "Gas and Electric Companies." It reads as follows:

"Every gas company and every electric company or company supplying or dealing in light or power by gas or electricity in a city shall pay a tax of one-tenth of 1 per cent on the paid-up capital thereof, and every gas company and every electric company or company supplying or dealing in light or power by gas or electricity shall pay a tax of 1 per cent calculated on the net revenue of the company earned within Ontario, but this shall not apply to any gas or electric works owned and operated by a municipal corporation."

The privately owned central stations of Ontario are now paying the tax of one-tenth of 1 per cent on their capital. The added tax is the 1 per cent on the net earnings of the companies within Ontario. The added burden is the fact that their competitors, the Ontario Hydro-Electric System and its various subsidiaries owned and operated by municipalities, are exempted from the new tax.

The preparation, introduction and advancement of this bill to a second reading was very quietly accomplished. The central-station interests had no warning of its impending passage until late last week. At the earliest opportunity telegrams were sent to most of the privately owned central stations in Ontario to send representatives to Toronto on Saturday, April 18, to appear as a committee of protest before the Cabinet of the Province of Ontario. On Saturday morning it was announced that the Cabinet would grant an audience to the committee at 2 o'clock that afternoon. This was the first opportunity the interests affected had had to appear in opposition to the bill.

The committee which was received by the Cabinet consisted of Messrs. D. H. McDougall, of the Toronto Electric Light Company, Ltd.; A. A. Dion, of the Ottawa Gas & Electric Company; E. P. Coleman, of the Dominion Power & Transmission Company, Hamilton, and Mr. Caldwell, of the Electric Power Company, Peterborough. This committee and the Canadian Electrical Association were represented by Mr. Hellmuth, K.C., of Toronto, as counsel.

Mr. Hellmuth made the principal address to the Cabinet, in the course of which he inquired if it was the purpose of the Ontarion government to break the privately owned central-station companies and force them into liquidation. One of the ministers replied that Mr. Hellmuth's question was a joke. Mr. Dion, in a brief but forceful address, made the point that competition fixes rates and that under the proposed bill, therefore, there would be no opportunity to raise the rates so as to include the additional tax of 1 per cent. Mr. McDougall had prepared a brief in opposition to the proposed tax. The following are extracts from it:

Electric-light companies of the Province of Ontario owned and operated by private interests represent capital invested of $110,000,000. The pay-rolls of these private companies for the year 1913 totaled over $2,000,000.

A very large percentage of this invested capital was secured from England and from outside the Province and was obtained on the faith of the contracts entered into by various municipalities giving exclusive rights within their boundaries, or, if not exclusive, then the statutes of Ontario at the time the franchises were granted provided that in case a municipality desired to enter the electric lighting, gas or street-railway business it was first compelled to buy out the existing company to which it had given a franchise.

The Hydro-Electric movement first of all annulled this provincial act as detrimental to the progress of the municipalities in compelling the observance of the conditions under which the franchises were granted. The government fostered and financially supported the municipalities in violating their contracts with the companies and in starting opposition and duplication of the companies' plant and distribution systems.

The private companies have always been compelled to pay taxes on their assessed values, whereas the plant of the municipality escapes taxes, which exemption is not an exemption of a municipal enterprise in the ordinary sense of the word, such as water-works, etc., which is of benefit to all classes of citizens, but is an exemption in favor of the few using the service of the municipality and a charge on a large majority of the ratepayers and citizens who do not avail themselves of the municipality's electric system.

In addition, the transmission of power by the provincial commission has been carried on by means of lines built mainly along the highways of the Province and operated at very high voltage. Notwithstanding this, the provincial commission refuses to pay any taxes whatever to the various municipalities through which they operate and refuses to contribute to the upkeep of the highways they use to a larger extent probably than any individual resident.

On the other hand, the transmission lines of the private companies are assessed for their full value, and these companies are compelled to procure in many cases a private right-of-way, which is also subject to assessment. The result is that before the electricity can reach the consumer in the municipality the capital invested to get it there is taxed for the transmission line and for the distribution in the municipality, whereas the Hydro equipment is exempted in both cases.

The Hydro propaganda was introduced with the avowed intention and announced program of doing business at cost regardless of the investment of legally operating companies. The earnings, therefore, at the present time where the Hydro competition exists do not give a fair return to the private companies, representing an investment of $110,000,000 which any government should be interested in protecting. The addition by the Province of a further tax of 1 per cent on the private companies' income would be not only unfair to the companies but an additional bonus or exemption to the few consumers of the Hydro-Electric Commission's electric energy and a charge indirectly on every other citizen of the Province who is not connected with its lines.

O. E. L. A. New-Business Meeting at Dayton

At Dayton, Ohio, on April 15, commercial members of the Ohio Electric Light Association held a meeting for the discussion of new-business topics. Mr. Thomas F. Kelly, sales manager of the Dayton Power & Light Company, presided, and Mr. Robert Montgomery, new-business manager of the Louisville Gas & Electric Company, read a paper, "A Successful House-Wiring Campaign," which had been prepared by Mr. E. F. Callahan, new-business manager for H. M. Byllesby & Company, Chicago.

At Louisville this situation was first approached by inviting the contractors to attend a noonday luncheon and conference, when figures were laid before them showing the large field of operation in sight. The contractors were requested to submit specifications and quotations on a flat-rate basis, making a price per outlet for the wiring and also a flat price for each fixture, including 40-watt tungsten lamps. The Louisville central-station proposed to bear all the expense of a vigorous advertising campaign and to devote the services of five salesmen to securing house-wiring contracts. After due deliberation the contractors submitted their specifications and quotations as requested, but these were found to be too high to make the campaign a success. The company then compiled a price schedule and made up an application blank which took the form of a contract between the electrical contractor and the customer. By the terms of this the contractor agreed to do the work on a time-payment plan of 25 per cent cash on completion of the work, the balance to be paid in twelve equal monthly payments.

Only one contractor accepted the proposition, and in addition to the large number of jobs turned over to this contractor by the company's salesmen he also receives practically an equal volume of house wiring without solicitation. All the other contractors are also doing much more business since the campaign started than they were theretofore. The sale of appliances has also increased materially. The official contractor has had to expand and specialize his own organization and now has an outside superintendent in charge of his forty-two wiremen. The capital required by him to carry on this business has been approximately $25,000. As evidence of his satisfaction with the price schedule followed, it may be noted that each week he gives $10 to be awarded as prizes to the two central-station salesmen closing the greatest number of contracts.

Mr. Callahan's paper was discussed at length by Chairman Kelly, Mr. R. H. Wright of Cleveland, Mr. Parker H. Kemble of Cincinnati, Mr. Fred Morrison of Newark, Mr. O. Wessel of Columbus and Mr. J. E. North of Springfield.

Mr. Parker H. Kemble, Cincinnati, opened the round-table discussion on "Handling the Chronic Kicker" and told how by having such complainants taken care of by able representatives the "kickers" could be eliminated. He described systems of card indexes and other methods used by some companies to keep track of this class of people, but questioned whether a large organization could afford the money required for this purpose.

During luncheon brief addresses were heard from Messrs. Charles Wuichet of Dayton, Ohio, and Frank M. Tait, general manager of the Dayton Power & Light Company and past-president of the National Electric Light Association.

The feature of the afternoon session was an address by Mr. R. H. Grant, sales manager of the National Cash Register Company, on the subject of "Salesmanship." In the evening a number of the delegates attended a dance given in their honor by the Dayton Power & Light Social Club.

Mr. Insull on the Centralization of Energy Supply

A large audience, including many men notable in the electrical industry, heard the address of Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, on the "Centralization of Power Supply," at the West Side Branch of the Young Men's Christian Association in New York on April 20. The meeting was one of those in the series held by the Finance Forum for discussion of the subject of public utilities. The speaker of the evening presented earnestly and in language that the layman could understand an argument for the treatment of the electric central station as a monopoly in order that there might be the fullest measure of conservation of energy, but said that this monopoly should be subject to regulation by the public. Mr. C. A. Coffin, chairman of the board of directors of the General Electric Company, presided as chairman of the evening. After speaking with warm praise of the work of the association, he paid high tribute to the ability and character of Mr. Insull. Among those who were on the platform were Messrs. E. W. Rice, Jr., O. D. Young, Arthur Williams, J. W. Lieb, Jr., J. B. McCall, Frank A. Vanderlip, W. W. Freeman, E. P. Russell, L. A. Ferguson, N. F. Brady, Thomas E. Murray, E. W. Burdett, Herbert A. Wagner, John F. Gilchrist and Gen. George H. Harries.

In his discussion of the subject Mr. Insull remarked that the topic was one that he had had the privilege of discussing a great many times. His remarks were illustrated by stereopticon views depicting charts and data which were the basis of the address. At the outset Mr. Insull said that he wanted to have it understood that the business in which he is engaged is essentially a monopoly business. It would be as absurd for every householder to have his own water supply, gas-producing apparatus, means of sewage disposal, transportation and communication by wire as for him to have his individual method of producing electrical energy. The economics of the situation demand a centralized supply of energy if the most economical results are to be obtained, if capital and labor are to be conserved, and if the prime sources of power, whether coal or water, are to yield the very best possible results for the user in low price and for the producer in yielding a proper, fair return on capital. It would seem that the day will come when regulating bodies will question the waste of capital, fuel and efficiency that goes on where the production of energy is not centralized.

Continuing, Mr. Insull said that one great trouble is that speakers who discuss the subject usually view it from their individual standpoint. They do not take the broad view, but discuss the matter from the point of view of pride and satisfaction with the power station with which their particular interests are concerned. Another class of men who discuss the subject do so without adequate knowledge of general conditions.

In beginning his references to statistics, the speaker said that they necessarily related in the main to the Chicago company, but he hoped to show that on broad economic grounds it is for the best interest of the whole community that this class of business should be run as a monopoly, with one system of distribution and one central authority of production. Necessarily, such a property should be regulated; so treated, the property will be the greatest conserver of the product at the lowest price to the consumer and the greatest possible profit within reasonable limits to the producer. The first chart displayed was that of a block of apartment buildings with 193 apartment customers and 34 hall-lighting and garage customers. The average number of lamps per customer was twelve and the total consumption per year was 49,620 kw-hr. Mr. Insull ex-

plained that the investment supplying the individual services would not be used more than 7 per cent of the time, but that the combination of many customers having diversified demands would increase the percentage use of the total investment. He said that the Chicago company was the pioneer in the use of Wright demand meters, and traced the development therefrom of rate-making schemes based on the percentage of connected load. The company has been installing, as fast as possible, meters showing a record of consumption. A number of the charts were based upon load conditions at 5:30 p. m. on Jan. 6, and showed the experience of the company with different classes of customers, as department stores, public garages, steel, iron and brass works, office buildings, stockyards and packing houses, telephone exchanges, offices, ice manufacturers, hotels, etc. In referring to the chart based on the experience with seventeen public garages Mr. Insull said that 854 vehicles were charged at an average cost of $109 per annum, or roughly 30 cents a day. "The charts," he said, "show the extreme desirability of knowing all that you possibly can about your own line of business."

In discussing the annual income from the sales of electrical energy and the sales per capita in different cities, the speaker said that where there is a low price per kilowatt-hour there is a high figure of sales per capita. He gave some statistics of sales of gas per capita to show that the per capita sales of electricity have passed those of gas. He showed that the income per kilowatt-hour is very high in London, England, and that the sales per capita are low and the load-factor relatively poor. The rule is almost invariable that as the income per kilowatt-hour goes down the output per capita goes up. Cost follows the line of income and the load-factor shows a decided improvement. After showing how the highest output per capita and the lowest income per kilowatt-hour of the points indicated were reported at Niagara Falls, Mr. Insull said that Chicago, with steam production of energy, is pretty close as to low income per kilowatt-hour and high sales per capita and good load-factor to the districts of hydroelectric power. To demonstrate the figures in another way, the speaker referred to statistics of the 1912 census. It was found that, although these figures show results by states, they indicate that relatively the same rule prevails as in the cities. It was also shown that all the great water-power states in the West are in the category of properties which show a low income per kilowatt-hour and high output per capita and an extremely high load-factor. In the development of water-powers it has been necessary in most cases to make a large investment. The territory served usually is sparsely populated and industries are relatively few in number. These plants had to take every class of business within reach. No one would think of producing his own power if a transmission line of a water-power company was anywhere within reach. The results shown by some of the hydroelectric companies are due in part to the very high prices of fuel in some states and in part to the very low prices quoted for energy. In most of the districts where hydroelectric plants operate steam plants are unknown except as they are used on the lines of railroads. Now mountain lines are undergoing electrification, and it is a matter of only a few years when this use of energy will be extended.

In referring to the fact that coal is relatively cheap east of the Mississippi River, Mr. Insull said that the coal supply is being used at a rate that seriously jeopardizes the resources of the country. The character of business that is done in the water-power states of the West should be done in the Eastern States in practically the same way with coal as the basis of energy. Particular attention was drawn in the address to the relatively unimportant proportion of lighting in the entire gross revenue of the central station. Mr. Insull also presented a chart showing a division of revenue. One-half of the expenditure represents the cost of money and the right to do business, that is to say, the taxes. Interest and dividends together represent a sum of about 6 per cent on the total cost of the money. The "saturation of the dollar" was mentioned and explained by the speaker. The sources of capital for additions to plants were explained. About $3 has been expended for additions from reserves for every $2 from new capital. In discussing the conservation of coal the speaker showed how greater output has been obtained. The consumption was 6.9 lb. per kw-hr. in 1900 as compared with 2.87 lb. in 1913. In his discussion Mr. Insull purposely refrained from references to the sale of energy for use by railway companies, as he wanted to show how it is possible to obtain a great diversity of business in districts where it does not seem practicable to sell the energy for transportation purposes. He showed a map of Illinois and, to emphasize his argument, indicated some of the results obtained in that State in the centralization of the energy supply, which he expressed as the benefits of massing all classes of business if it is desired to obtain the highest possible efficiency of apparatus and the highest possible efficiency of earning power. Demonstrating that it is possible to get the highest measure of centralization in a single large community, Mr. Insull said that he could not see why the principle does not apply to small places.

In conclusion the speaker expressed strong views in regard to commission regulation of public utilities. He said that it is unreasonable to expect that the community should allow a business of the kind described to go on without regulation. Assuming that regulation is intelligent, the investor and the user have nothing to fear from it. If the companies are not managed well enough to square with public opinion, the commission is there to protect the public. If the community is so ill advised as to treat the company unfairly, the commission is there to protect the company. Admitting that commission regulation is an inconvenience to men who deal with large properties, Mr. Insull still maintained that regulation is the best thing that has happened to the electrical industry in the last few years. He believes that in the long run regulation means protection. That does not seem to be a very popular statement in view of the treatment or assumed treatment that the railroads are receiving from the Interstate Commerce Commission. Still, Mr. Insull believes that regulation is the best thing for the securities, for the widows and orphans who are largely represented in the ownership of securities and for all interests. The business is a natural monopoly, and if it is a monopoly it should be regulated. The companies should get fair treatment, but in order to get fair treatment they must be fair to the people with whom they deal. It is the judgment of Mr. Insull that in the next few years there will be scarcely a spot in the settled districts of the country and especially east of the Mississippi Valley where it will not be possible to get electrical energy for all purposes at all hours from one central station. The central station has closer relations to more classes of people than any other line of industry. More can be done in the conservation of resources, in lessening the severe conditions of labor, in improving the condition of poor people and in opening up districts for settlement. There is scarcely a direction in which one can look without seeing new possibilities. The electrical industry is the greatest one engaged in public service. Mr. Insull told his hearers that they could do no greater injury to themselves than to deal unfairly with the industries that have built up the country.

Public Service Commission News

Illinois Commission

The constitutionality of the law creating the State Public Utilities Commission of Illinois has been attacked by the city of Chicago. The municipality of Berwyn, Ill., a suburb of Chicago, has petitioned the commission to compel the Chicago Railways Company to grant a 5-cent fare to the center of Chicago. Inasmuch as the city of Chicago is virtually in partnership with the street-railway company, receiving 55 per cent of the "net divisible receipts" under the 1907 traction settlement ordinances, it is made a party to the proceeding. This gave Mr. Sexton, the corporation counsel of the city, an opportunity, in his answer, to attack the validity of the law. Governor Dunne, who was formerly a judge, has expressed the belief that the law is constitutional. Counsel for Mr. Samuel Insull, receiver for the Chicago & Oak Park Elevated Railroad Company, have questioned the authority of the commission to compel the receiver (appointed by the federal court) to elevate the tracks in the suburban community of Oak Park. In a statement Mr. Insull said that he thinks the tracks should be elevated; the question is the ability to provide the means therefor. Mr. Insull says this question is for the court, and he is careful to say that no "defiance" of the commission is intended.

New Jersey Commission

The Public Service Electric Company has appealed to the Supreme Court from the recent order of the Board of Public Utility Commissioners directing it to furnish electric service free of charge to the municipal buildings of Plainfield, in accordance with the contract under which its charter was received. The company claims that such enforcement violates both the state and federal constitutions and the act of 1911 prohibiting free service, and that such act abrogates the contract between the city and company.

Wisconsin Commission

After an extended investigation into the rates and service of the Stevens Point Lighting Company, the Wisconsin commission has issued an order adjusting the rates and demanding a fuller compliance with the commission's rules of service. The former rate for electric lighting is 13.5 cents per kw-hr. The rates prescribed are as follows: Primary rate, 12 cents per kw-hr. for the first thirty hours' use per month of the active connected load; secondary rate, 7 cents net for the next sixty hours' use per month of the active connected load; excess rate, 5 cents net per kw-hr. Lighting consumers are to be divided into classes A, B and C, in accordance with the usual practice of the commission. The following motor-service rates were prescribed: Primary rate, 10 cents net per kw-hr. for the first 15 kw-hr. used per active kilowatt connected per month; secondary rate, 4 cents net for the next 45 kw-hr. per active kilowatt connected; excess, 2 cents net. The active connected load is to range from 90 per cent of the first 10 hp to 50 per cent of the connected load over 60 hp. The minimum bill will consist of a charge of 50 cents for the first 2 active hp connected and a charge of 25 cents for each additional horse-power. The rate for street lighting was reduced from $78 per lamp per year to $54. The effect of this rate adjustment will be to increase the revenue from the motor service while materially reducing the income from commercial lighting and street lighting. The revenue as a whole will be reduced.

The McGowan Water, Light & Power Company has been authorized to establish a minimum charge of 75 cents per month.

Ohio Commission

The Cleveland Electric Illuminating Company will soon ask the Ohio commission to review the new ordinance recently passed by the City Council of Cleveland fixing the rate for service at 3 cents per kw-hr. It is said that the company will resist the ordinance and endeavor to show that a city has no right to fix a rate which is unreasonably low. It is possible that the matter of a city's authority to fix rates at all will be questioned also.

The Union Gas & Electric Company, of Cincinnati, has agreed to the request of the commission to make a physical valuation of its properties. A committee will be appointed to work with the representatives of the commission in making the valuation.

Washington Commission

The third annual report of the Public Service Commission of Washington covers the period from Dec. 1, 1912, to Nov. 30, 1913. It refers to various activities of the commission.

The engineering department has been engaged in gathering data for physical valuation of a large number of public service properties. About $20,000,000 of properties were valued during the year. The more important are the properties of the Pacific Power & Light Company, some of the subsidiary corporations of the Puget Sound Traction, Light & Power Company, and the Grays Harbor Railway & Light Company. During the ensuing year it is expected to complete appraisals and rate investigations of the Seattle Lighting Company, the Washington Water Power Company, the long-distance lines of the Pacific Telephone & Telegraph Company and the Puget Sound Traction, Light & Power Company, in addition to such miscellaneous investigations of smaller plants as will come up incidentally in the ordinary course of the work.

The Pacific Telephone & Telegraph Company presented and filed tariffs covering toll-line charges throughout the State. For the first time these tariffs were based upon a scientific plan, the rates being determined by an initial charge plus an air-line toll mileage. The commission declined to pass upon the reasonableness of the rates and continued the matter, with the new rates in effect, until such time as a study can be made of the actual operation of the rates and initial time.

The new act relating to electrical construction set out a number of rules and provided that these could be amended and supplemented by the commission. A number of matters of construction were not covered by the rules set out in the act, so the commission held a hearing at which proposed changes and supplementary rules were discussed. The law which gave the commission jurisdiction over this work carried no appropriation, so the expense of enforcing the statute must be borne by the general appropriation made by the Legislature for the expenses of the commission.

Indiana Commission

The Indiana Railways & Light Company, of Kokomo, has just had its supplementary schedule of rates approved by the Public Service Commission of Indiana. The changes made are of significance in that they are all "downward" and that the revision came voluntarily from the company. The discount on individual consumers' bills which range from $1 to $5 a month was increased from 5 per cent to 10 per cent. In certain residence lighting rates the new schedule provides for a reduction of prices from 11 cents per kw-hr. to 10 cents per kw-hr. Mr. T. C. McReynolds is secretary and general manager of the Indiana Railways & Light Company.

Current News Notes

Automobile Engineers Plan Trip to Europe.—The Society of Automobile Engineers is arranging a European trip for its members, which is to include visits to the principal motor-car exhibits of the year in London and Paris. The present intention is to leave New York Oct. 9, returning from Southampton Nov. 15.

* * *

Abstracts of Engineering Articles.—"A Bulletin of Abstracts" of articles from domestic and foreign publications relating largely to the gas and electrical engineering fields is being published bi-monthly by the American Gas Institute. Each issue contains about 160 pages punched and arranged to be separated and filed in accordance with a uniform filing classification.

* * *

Miners Demand Electrical Equipment in Collieries.—At a recent conference held in Philadelphia between the miners and operators of Pennsylvania the representatives of the miners demanded that the cars which move in and out of the collieries of the mine should be operated by electricity, asserting that the task of pushing the heavy cars in and out of the mine was too much for the men. The operators objected to this demand on the ground that it would increase the cost of production from 7 cents to 14 cents a ton.

* * *

Wireless Towers for Panama.—The United States government is erecting three 600-ft. steel towers near the Gatun Locks, Canal Zone, Isthmus of Panama, which will be used to support the antennas of the Panama wireless-telegraph station. The towers will be of triangular section, measuring 150 ft. at the base and tapering to 10 ft. at the top. The three towers will require about 1000 tons of steel. The steel work is now being fabricated at Toledo, Ohio, and will be erected by the Childers Construction Company, of Columbus, Ohio.

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SOCIETY MEETINGS

Coming Dayton Rejuvenation.—Statesman Thomas F. Kelly announces that the next rejuvenation and joviation of the Jovian Order in Dayton, Ohio, will be held at the Dayton Club on May 9.

* * *

Electric Club to Give Entertainment.—The Electric Club of Chicago will give an entertainment and smoker on the evening of April 29, and has appropriated an amount not to exceed $600 for the purpose. No admission fee will be charged to members.

* * *

Duquesne Section, N. E. L. A.—The Duquesne Light Company Section of the National Electric Light Association held its annual banquet at Pittsburgh, Pa., April 16, with 500 members present. Mr. E. C. Stone, chairman of the section, introduced the speakers, Mr. F. E. Harper, who described the electrical equipment in Kaufmann's new store, Pittsburgh, and Mr. E. D. Dreyfus, who talked on the topic "Electric Service—Prospective and Retrospective."

* * *

Annual Meeting of the Society for Electrical Development.—The annual meeting of the Society for Electrical Development, Inc., will be held at the Bellevue-Stratford Hotel, Philadelphia, June 1. The object of calling the meeting at that time is to enable those attending the N. E. L. A. convention to attend the annual meeting of the society also. New directors will be elected, and immediately following the board of directors will elect officers for the coming year.

* * *

New Jersey Jovians to Celebrate.—The first Jovian rejuvenation in New Jersey will take place on Tuesday evening, May 19, at 8 o'clock, at Stetter's Restaurant, 842 Market Street, Newark, N. J. The rejuvenation will be in charge of Statesman W. C. Andrews, Edison Storage Battery Company, Orange, N. J., and Alternate Statesman S. H. M. Agens, of Agens & Hopper, Newark, N. J. The champion New York degree team, on which Statesman Andrews formerly took the part of Jupiter, has promised to officiate.

* * *

Jovian Rally in Toledo.—A Jovian rally of unusual interest and proportions was held in the Zenobia Theater, Toledo, on the evening of April 17. A large audience was present. The master of ceremonies was Mr. H. F. Adams, and speeches were made by Messrs. Sam A. Hobson, Chicago; A. A. Gray, Chicago; H. H. Cudmore, Cleveland; S. E. Doane, Cleveland; Thomas Valentine, Atlantic City; H. E. Niesz, Chicago; Henry L. Doherty, New York; E. H. Haughton, Chicago, and Elbert Hubbard, East Aurora, N. Y. The purposes of the Jovian Order were explained and the speakers of the evening also made several references to the work undertaken in Toledo by Mr. Doherty. Telegrams were received from Messrs. C. A. Coffin, Thomas A. Edison, G. E. Tripp, C. P. Steinmetz and others. All present were entertained at a buffet luncheon by the Toledo Railways & Light Company at the conclusion of the proceedings in the theater.

* * *

Chicago Electric-Vehicle Men in Session.—At the meeting of the Chicago Section of the Electric Vehicle Association held on April 21 it was decided to abandon the weekly luncheon meetings, for a time at least. It is planned to hold an evening meeting once a month, the members taking dinner together and afterward holding a business meeting with some social features. Mr. W. H. Metcalf, of the Woods Electric Garage, Philadelphia, gave a talk on the work of the Philadelphia Section of the Electric Vehicle Association. In that city there are 640 electric trucks and 446 electric pleasure cars, the figures relating to the city of Philadelphia proper and not including the suburbs. Mr. Metcalf spoke also of the development of small electric industrial trucks, such as are used in and about factories. The annual meeting of the Chicago Section will be held at the Hotel Sherman on May 5, beginning with a dinner at 6:30 p. m.

* * *

Minneapolis Electrical Fraternity.—Promoted by the Jovian Order, the Minneapolis Electrical Fraternity has been organized at Minneapolis, Minn., to foster good fellowship among local electrical men and to encourage electrical, technical and scientific education. The organization will meet every Tuesday at the Hotel West. The officers are as follows: President, Mr. O. M. Frykman; vice-president, Mr. F. G. Dustin; treasurer, Mr. G. G. Fletcher, and secretary, Mr. W. T. White. The committees are: Ways and means committee—Messrs. T. D. Crocker (chairman), T. W. Findley and A. W. Zahm; educational committee—Messrs. L. N. Cooper (chairman), R. F. Geeseka and O. A. Rofelty; entertainment committee—Messrs. C. E. Hansing (chairman), Paul Joslyn and W. H. Reker; membership committee—Messrs. Guy See (chairman), C. R. Becker and R. S. Chase; executive committee—Messrs. O. M. Frykman (chairman), F. G. Dustin, W. T. White, G. G. Fletcher, L. H. Cooper, T. D. Crocker, C. E. Hansing and Guy See.

Electric System of Laclede Gas Light Company

High-pressure steam turbo-generating plant, auxiliary low-pressure station and substations of a combined gas and electric utility in St. Louis, Mo.

LIKE a considerable number of other public-utility companies in American cities, the Laclede Gas Light Company, of St. Louis, sells both gas and electrical energy to its customers. Its activities as a distributer of gas are city-wide, but it serves only a portion of the city with electrical energy. Alternating-current electrical energy is distributed over single-phase feeders for lighting, while there is a separate three-phase alternating-current service for motors. The company has a considerable number of industrial customers in the central portion of the city, and these are supplied with 550-volt direct current obtained by means of rotary converters. All electrical energy is generated as alternating current.

Turbine-Room Apparatus in Main Station

Two 3500-kw and one 1000-kw General Electric alternator, delivering energy at 4150/2400 volts, sixty cycles, from a Y-connected three-phase winding, compose the main alternating-current equipment of the new generating station. Excitation for these three units may be furnished from any one of three sources, namely, a steam-turbine-driven 75-kw, 3300-r.p.m. General Electric generator; a 100-hp, 4150-volt, 75-kw induction motor-generator set, or a 320-amp-hr. storage battery. The battery has tanks large enough to permit of doubling the number of plates and hence the rating. With the present plate equipment, the battery will carry the entire exciter load for one-half hour.

A considerable portion of the company's 550-volt direct-current load is carried by two three-bearing motor-generator sets in the main station. Inasmuch as the motor ends of these machines consist of 565-kva, 4150-volt synchronous motors operating at 720 r.p.m., the power-factor of the main buses in the station can be regulated by varying the excitation of the synchronous motors. The generators are 500-kw, 550-volt commutating-pole General Electric direct-current machines.

The circulating water for the two large condensers is supplied by two 16-in. tri-rotor volute pumps driven by Curtis turbines, and that for the small one by a 10-in. volute pump driven by a Terry turbine. These pumps are installed in a pit in the middle of the turbine room

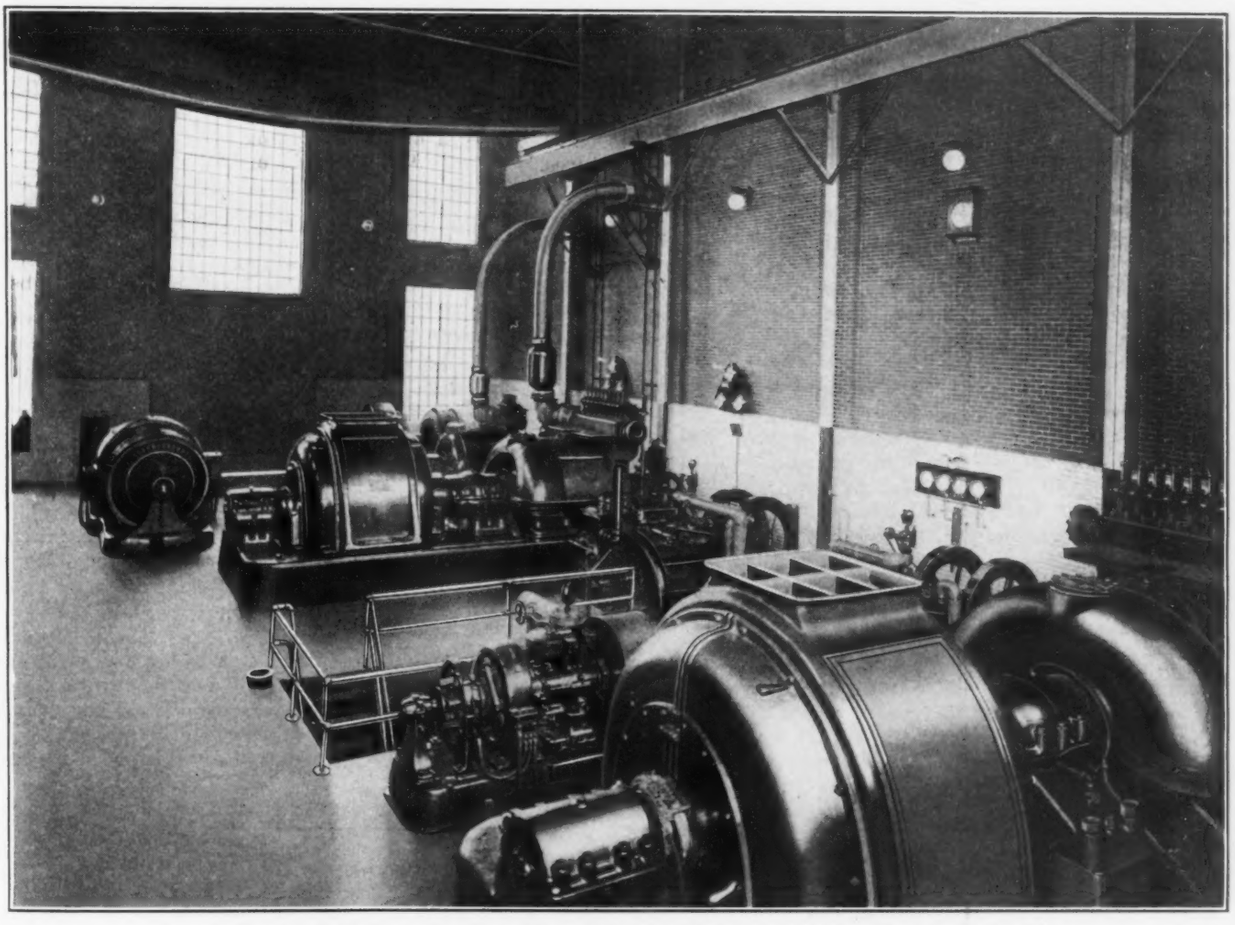


FIG. 1—TURBINE ROOM OF THE LACLEDE GAS LIGHT COMPANY POWER STATION

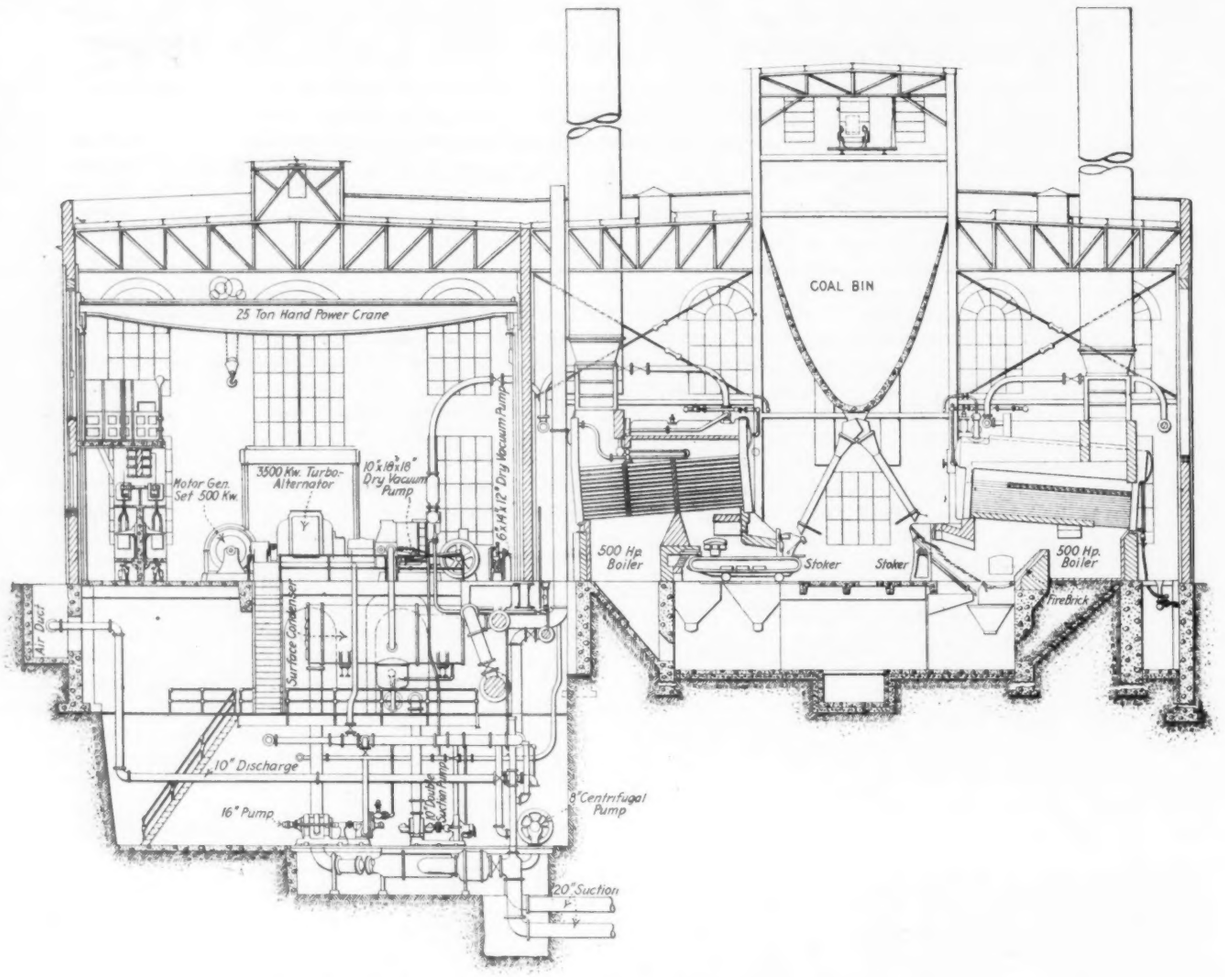


FIG. 2—CROSS-SECTION OF GENERATING STATION LOOKING EAST

and draw their water supply from the Mississippi River through two 20-in. pipe lines. After passing through the condensers the water is returned to the river through a 30-in. line sealed off in the river to have a siphon effect, which aids in circulating the water. In addition to this pumping equipment, there are two 12-in. volute pumps of 6000-gal. a minute capacity on the river bank. These pumps are driven by 150-hp, 440-volt induction motors and are available for emergency service.

Three two-stage hot-well pumps serving the condensers are driven by two 10-hp and one 5-hp, 440-volt induction motor. The dry-vacuum pumps, however, are steam-driven. All the auxiliaries in the turbine room are operated from a 6-in. header which loops the condenser pit and is fed from the main header in the boiler room.

The Steam-Generating End of the Station

On the south side of the firing aisle in the boiler room have been placed four 500-hp Heine boilers equipped with superheaters and delivering steam to the header at 185-lb. pressure with 100 deg. superheat. Across the aisle is a battery of four 500-hp Edge Moor boilers with Foster superheaters delivering steam at the same temperature and pressure. Stokers on the former boiler equipment are of the Ross type and are driven by a small auxiliary steam engine, while the Edge Moor boilers are fired by Green chain-grate stokers driven by a 5-hp, 440-volt induction motor.

Boiler-feed water is supplied through a 3000-hp open heater to two Alberger four-stage turbine-driven centrifugal pumps capable of delivering 400 gal. of water a minute. These pumps supply water to the boilers through a 6-in. feed main which is built so as to loop the boiler room.

For supplying natural draft to each pair of boilers 6-ft. by 150-ft. steel stacks have been erected. Each stack stands behind its respective battery of boilers so that all breechings are short. In addition to generating steam for the turbo-generator units in the electric station, these boilers supply steam for the gas works near by, the quantity of steam being measured by a General Electric flow meter which is placed in the boiler room.

Coal arrives at the company's premises over the tracks of the Wiggins Ferry Railroad and is dumped outside the plant into hoppers constructed under a spur track. An apron conveyor driven by a 5-hp, 440-volt induction motor carries the coal from these hoppers through a crusher operated by a 15-hp motor, from which it falls directly into a Peck conveyor to be taken to the overhead bins. As is shown from the cross-sectional drawing of the station, the overhead parabolic bunker is suspended from heavy girders above the firing aisle.

Fine coal and ash falling from the grates drop into separate bunkers beneath the boiler room. Helpers about the plant open the gates of the ash and fine-coal hoppers alternately and shovel their contents into the Peck conveyor, which takes the fine coal to the bunkers overhead or the ashes to the ash bin as the case may

be. A large yard is available for coal storage between the electric plant and the company's gas works.

Switching and Station Control

The twenty-six-panel black-slate switchboard controlling the station is situated on top of the oil switch and bus structure. Different panels of the board have been arranged in groups according to the nature of the apparatus they control. The first seven panels at the left control the direct-current generators and ten outgoing direct-current 550-volt circuits, while each of the next six panels in order controls two single-phase, alternating-current lighting circuits. The distribution system of the company is rather unique in that most of the motor service is on three-phase circuits completely separated from the lighting distribution lines, and these motor-service circuits are controlled from the three panels next in order along the board. Following a blank panel left for the installation of a future turbo-generator are three panels controlling the electrical equipment of the 1000-kw and the two 3500-kw alternators. The remaining panels carry respectively control apparatus for two synchronous motors of the motor-generator set, a Tirrill regulator, switches and instruments for the induction motor for the 75-kw exciter, and the direct-current 125-volt machines furnishing excitation.

Three buses are carried along the top of the bus and switch-cell compartments, and beneath these are arranged the disconnecting switches. In the lower part of the structure are the oil switches. Beneath the blank panels of the switchboard empty cells have been arranged so that the installation of future apparatus will not complicate the switching arrangement. Energy for the solenoid-operated switches is taken from the 125-volt direct-current excitation bus.

Totaling instruments for the station have been placed upon a separate switchboard standing at the end of the main board at right angles to the bus structure. Two curve-drawing meters, two watt-hour meters and two recording voltmeters make up the instrument equipment. Inasmuch as there are many more lighting feeders than there are recording voltmeters, the operators have resorted to an interesting wiring "kink" enabling them to obtain voltage records from any feeder. To accomplish this, plug socket receptacles have been installed in multiple upon the voltmeter circuits and one receptacle has also been installed in each lighting-feeder circuit. Thus, by attaching two plugs to the ends of a two-conductor cable, any feeder may be connected to the voltmeter circuit. A similar arrangement at the totaling board allows either meter circuit to be plugged to either of the recording voltmeters.

Wiring and Special Equipment

All high-tension wiring, connecting the machines and the bus structure and extending from the bus structure to the outgoing conduit ducts, is carried on iron pipe racks swung from the basement ceiling and along the station walls in fiber pipe conduit. Outgoing lighting feeders are carried through a bank of eleven induction regulators in the basement of the station. The

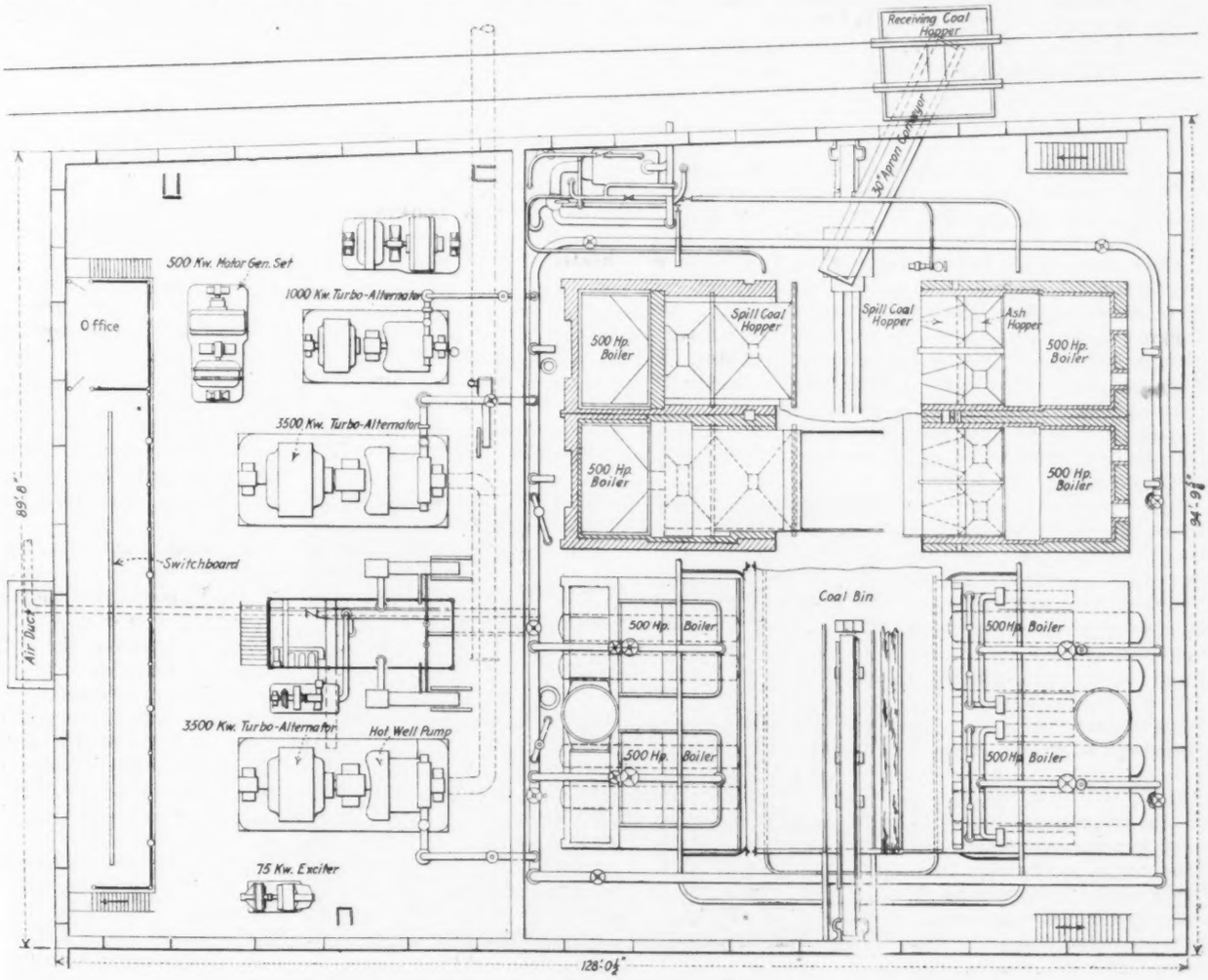


FIG. 3—FLOOR PLAN OF LACLEDE COMPANY'S STATION, ST. LOUIS

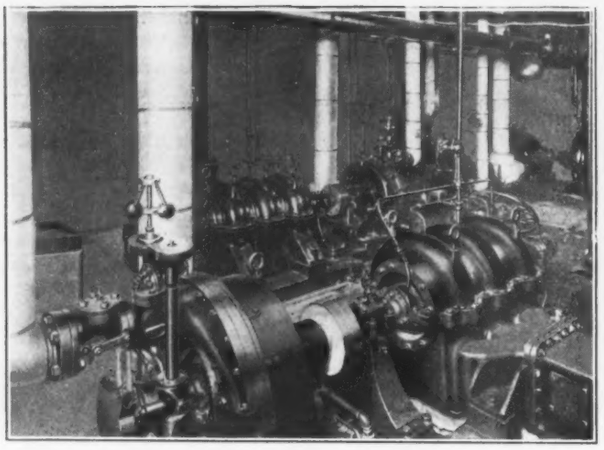


FIG. 4—TURBINE-DRIVEN TRIROTOR

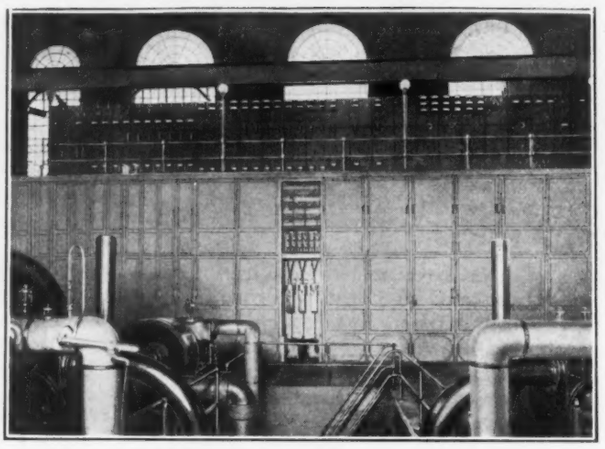


FIG. 5—SWITCHBOARD, SHOWING BUS STRUCTURE

connections of these regulators have been so arranged that each of them may be taken out of the circuit at any time for inspection or repairs by manipulating the disconnecting switches.

In the main generator room of the station a new and less exciting use has been found for the deep-toned Klaxon horn, which is so often used on automobiles. This instrument is mounted upon the gage board and is used to summon operators to various parts of the station or to notify them when a machine is to be placed on or taken off the line. On the same gage board are recording steam gages and vacuum gages for the turbines and condensers. Three sets of red and white pilot lamps on this board tell at all times whether or not the hot-well pumps are in operation.

Direct-Current Station Operating on Exhaust Steam

Besides its main generating station, the Laclede Gas Light Company has an interesting direct-current generating station situated in its gas plant at Second and Rutger Streets. Here are a number of Ideal steam engines engaged in pumping gas from the plant to the company's high-pressure gas system. These engines operate throughout the greater part of the day, sending gas to outlying holders. The exhaust steam from these units is gathered into a header and feeds a 300-kw, three-phase, sixty-cycle, 3600-r.p.m. Westinghouse turbo-alternator set which generates energy at 367 volts and is connected by a solid tie line without switches to a rotary converter. By this combination the company is able to secure 550-volt direct-current energy for its distribution system without the disadvantages of the high-speed direct-current generator. By connecting the alternating-current end of the rotary and the turbo-generator with a solid tie line the entire system of units is started and stopped as one.

500-Volt Substations

In addition to the 550-volt motor-generators in the main generating station and the converter in the gas plant on Second Street, the company has two other substations, one of which is situated at the corner of Sarah Street and Evans Avenue, while the other is in the Dominion Building on Seventh Street. In this latter plant a rotary converter has been installed. Between the transformer secondary windings and the rotary converter a three-phase induction regulator arranged for 10 per cent buck and boost has been connected so that the voltage of the direct-current system may be varied from 400 volts to 600 volts by varying the potential of the alternating-current energy supplied to the converter. This substation is installed in a building next to the Railway Exchange Building and the switchboard is equipped with the necessary switching and metering apparatus to control energy supplied during the summer to this building (see *Electrical World*, Aug. 16, 1913).

The substation at the corner of Sarah Street and Evans Avenue contains a 340-kva motor-generator set receiving alternating current at 4150 volts and delivering energy to the direct-current system in that neighborhood. This station is also equipped with induction regulators and switching apparatus to control the lighting service in the West End residence territory.

Electrically Operated Gas Works

The company has just completed two machine-operated retort houses which, together with a third finished about two years ago, are completely equipped with electrically operated charging and discharging machines and machinery for handling coal and coke. The total connected motor load at the gas-manufacturing plants of the company amounts to between 600 hp and 700 hp.

Mr. C. Holman is president and general manager of the Laclede Gas Light Company, and Mr. G. B. Evans is assistant general manager and chief engineer. In the electrical department the chief engineer is assisted by Mr. William Bradford, electrical engineer; Mr. William Gallaher, superintendent of electrical department, and Mr. C. S. Peters, assistant electrical engineer in charge of substations. Mr. W. T. Daniel is chief engineer of the main generating station.

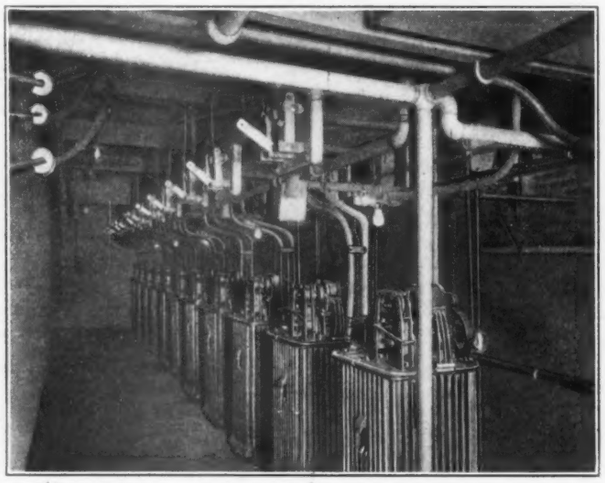


FIG. 6—FEEDER-VOLTAGE REGULATORS

High-Voltage Transmission Systems of the World

Plants in operation or under construction in every quarter of the globe which are designed to work at voltages of 70,000 or more. By Selby Haar

THE purpose underlying the compilation of the table printed in the form of a supplement accompanying this issue of the *Electrical World* was to assemble data covering all the transmission plants in the world intended to operate at 70,000 volts or more which are either in operation or under construction. It is confidently believed that there are no omissions in the table, several plants about which definite information is not at hand having been included to insure its completeness. An effort has been made to exclude all developments still in the proposition stage, such as the Victoria Falls scheme in South Africa, the one from the river Rhône to Paris, France, at about 150,000 volts, one from Trollhättan, Sweden, to Copenhagen, Denmark, at about 100,000 volts, and several in the southern part of the United States.

The selection of 70,000 as the lowest value of volts may require some explanation. At the outset of the work it became evident that even by setting the limit at 60,000 effectiveness would be sacrificed to bulk. Moreover, roughly speaking, 70,000 volts marks the change from the thoroughly standardized older practice used for pressures up to 66,000 volts to the newer long-span construction.

The voltage reported is the one at which the system is designed to operate; thus, 150,000 volts is given for the Pacific Light & Power Company (No. 1), although it is operating at about 135,000 volts, and 140,000 volts for the Southern Sierras Power Company (No. 3), which after a considerable period of running in parallel with its parent company, the Nevada-California Power Company, at 55,000 volts (its transformers are designed for 55,000, 87,000 and 140,000 volts) is about to change to 87,000 volts. The present station equipment rating is intended to represent that value of power which can be delivered to the transmission lines under normal conditions. Furthermore, auxiliary plants, whether used for increasing the generating equipment of the system or for stand-by service, have been omitted when they are situated at or near the end of the main transmission lines. This is the case, for example, of the Southern California Edison Company, which has a large steam plant at Los Angeles, and the Ebro Irrigation & Power Company, Ltd., which has at Barcelona a steam station that is one of the largest in the world under one roof. The total station equipment is not always concentrated in one plant; in all cases the figure stated in the table is based on generator ratings.

In the hydraulic details it has been impossible to avoid some indefiniteness, due to the difference between English and metric horse-power, the failure of those supplying information to distinguish between the maximum rating of the waterwheel, which is the figure usually stated by the turbine manufacturer, and a normal rating with sufficient reserve to carry as much temporary overload as the generator, and also to the confusion between static head and actual head at the turbine under load conditions. There is also a persistence of the habit of overlooking the difference between kva and kw ratings of generators, and an endeavor has been made to give the manufacturer's rating in all cases. Allowance must be made for differences in standards for rating machines. Foreign-built generators are likely to be rated on a maximum continuous basis, such as was proposed at the mid-winter convention of the A. I. E. E. last February and is already in use in the United States in the case of turbo-generators. The same practice has occasionally been adopted here, the 12,500-kva machines of the Great Western Power Company and some others being rated on this basis. All the generators listed in the table are three-phase machines with the exception of the 80,000-volt installation of the Swedish State Railways, which is single-phase. The name of the manufacturer of the generators is that of the parent company, even though a branch or affiliated factory may have actually built the machines. The same rule has been followed in connection with other apparatus.

The discrepancies between the total and individual ratings of step-up transformers, and also between transformer and generator ratings, are due to the inclusion of reserve units, differences in rating and the rounding off of the totals. For example, the total rating of the Central Colorado Power Company transformers corresponds to 50 per cent overload, while the rating of the generators of the Ebro Irrigation & Power Company, Ltd., being on a maximum continuous basis, is 25 per cent greater than the normal rating of the transformers. No attempt has been made to list the sizes of step-down transformers as the local conditions of each installation preclude the possibility of standardization in this respect.

The distance of transmission stated under "transmission lines" is the distance between the points mentioned and represents the farthest point to which energy is transmitted at this voltage, no attempt being made to include either all the lines or the total mileage. All but one—the Swedish State Railways—are three-phase lines. By height of towers is meant the length from ground level to the extreme top, this dimension having been chosen because it is most accessible in published descriptions. The number of circuits per tower (usually three conductors each) is the standard arrangement, but in some special cases entirely different methods of support are used. The same remark applies to the arrangement of conductors on the towers and the distance between conductors.

Under "lightning protection," which, of course, is intended to guard against damage from excess voltages of all kinds, only the most prominent devices are mentioned; for example, arc suppressors and oil switches with damping resistances are also in use on some lines. Switch plant means not only switchboards but also all high-tension controlling and overload protective devices.

No conclusions can be drawn from the hydraulic data, because the basis of selection of plants is entirely electrical. Neither the highest and lowest head nor the most powerful waterwheel is included in the table. The generator of highest rating is 18,000 kva steam-driven or 17,500 kva water-driven, the most powerful is 14,875 kw, the smallest 750 kw. Specified power-factors range generally from 0.80 to 0.90, although one plant is de-

signed for a power-factor of 0.60 on account of an electrometallurgical load. The number of units in one station varies from one to fifteen.

The list of transformer ratings seems to indicate a trend away from the polyphase unit, most of the newest systems having single-phase transformers. One polyphase transformer or group of single-phase units for each generator is the general rule. With the exception of three plants, all of which were equipped by one manufacturer, delta connection is used in at least one of the transformer groupings. The column of high-tension voltage of the step-down transformers shows different opinions as to the most suitable value of line drop and different methods of allowing for it. Where the rated high-tension voltage of both groups of transformers is the same, taps on the windings are provided.

The longest transmission is about 240 miles. The normal span ranges from 450 ft. to 850 ft., the average being about 625 ft. Most of the lines are strung on double-circuit towers, and few have a total of more than two circuits. The strong predominance of copper as a conductor may be due to commercial causes, but in all of the foreign systems (outside of America) use is made of copper conductors. The hemp center seems to have disappeared. A very popular arrangement of conductors is the vertical, but, as the result of some unfortunate experiences, the middle conductor is now moved out of the plane of the other two. Since atmospheric conditions exert a considerable influence on the dielectric strength of air, any figure for the average spacing would be of little value. A like condition exists with respect to the insulators. Numerous ingenious arrangements are used for connecting strings of suspension insulators in multiple to carry heavy stresses. The overhead ground wire is apparently firmly established as a protective measure, one system (No. 13) using it also to stiffen the line.

The arresters are largely of the electrolytic type because American firms have equipped most of the plants. Of the two plants for more than 100,000 volts which use the horn-gap and series resistance protection, one has not yet been placed in service.

A noteworthy development in methods and apparatus for the control and switching of circuits has been the introduction of outdoor devices. At least three plants have complete installations of busbars, switches and circuit-breakers (some oil-break, others air-break), while others have less elaborate ones.

The author wishes to express his thanks to the numerous engineers, representatives of manufacturing companies and others who have responded willingly to his requests for data for presentation in the table.

LIST OF ABBREVIATIONS USED IN TABLE OF HIGH-TENSION TRANSMISSION PLANTS

A.G.—stock company.
Al.—aluminum.
Ca.—approximately.
Conn.—connection.
Cu.—copper.
D.—directly.
Dist.—distance.
H.—hydraulic, or horizontal.
H.T.—high tension.
Hydr.—hydraulic.
Liq.—liquid.
L.T.—low tension.
Mfg.—manufacturing.
Pr.—power.
R.—resistance.
Ry.—railway.
S.—steam.
S.P.—steel poles.
St.—steel.
S.T.—steel towers.
Susp.—suspension.
Transf.—transformer.
Transm.—transmission.
V.—vertical.
W.P.—wood poles.
A.E.G.—Allgemeine Elektricitäts Gesellschaft.
Al.Ch.—Allis-Chalmers.
Br.Bov.—Brown, Boveri.
Al.Sv.El.Akt.—Allmanna Svenska Elektriska Aktiebolaget.
C.W.—Crocker-Wheeler.
Day.—Dayton Iron Works.
Esch.W.—Escher-Wyss.
G.E.—General Electric Company.
M.A.N.—Maschinenfabrik Augsburg-Nürnberg.
Nippon Toki GK—Nippon Toki Gomei Kaisha.
Oh-Br.—Ohio Brass Company.
Penna. China.—Pennsylvania China Company.
Sm.—S. Morgan Smith.
S. M. Smith—S. Morgan Smith.
S.S.—Siemens-Schuckert Werke.
W—Westinghouse Electric & Manufacturing Company.
W.S.M.—Wellman, Seaver, Morgan Company.

"Electrical World" Articles

News items and descriptive articles relating to the installations operating at and above 100,000 volts have appeared from time to time in the *Electrical World*, as follows:

Pacific Light & Power Company, June 1, 1912, p. 1192; June 22, 1912, p. 1342; Nov. 29, 1913, p. 1108; Jan. 3, 1914, p. 33, and Jan. 10, 1914, p. 85. Au Sable Electric Power Company, April 13, 1912, p. 795; April 20, 1912, p. 843; June 1, 1912, p. 1195. Southern Sierras Power Company, Aug. 10, 1912, p. 298; Aug. 2, 1913, p. 234. Utah Power & Light Company, July 12, 1913, p. 106. Pacific Gas & Electric Company, Nov. 22, 1913, p. 1055. West Penn Traction & Water Power Company, June 8, 1912, p. 1280. Tennessee Power Company, April 13, 1912, p. 820; March 22, 1913, p. 644; March 29, 1913, p. 696; May 24, 1913, p. 1111; Oct. 25, 1913, p. 868. Connecticut River Transmission Company, Oct. 4, 1913, p. 685; Oct. 11, 1913, p. 737. Inawashiro Hydroelectric Power Company, March 9, 1912, p. 524; May 17, 1913, p. 1058. Grand Rapids-Muskegon Power Company, Nov. 3, 1906, p. 841; Nov. 2, 1907, p. 850; Feb. 4, 1909, p. 354; Sept. 16, 1909, p. 664; June 1, 1912, p. 1195. Ontario Hydro-Electric Commission, Jan. 6, 1912, p. 33; Jan. 13, 1912, p. 96; Jan. 20. 1912, p. 137; June 1, 1912, p. 1195. Lauchhammer Actien-Gesellschaft, Oct. 28, 1911, p. 1057; June 1, 1912, p. 1195. Georgia Railway & Power Company, May 4, 1911, p. 1127; June 1, 1912, p. 1195; Dec. 20, 1913, p. 1257; Dec. 27, 1913, p. 1309. Alabama Interstate Power Company, Jan. 4, 1913, p. 68; June 7, 1913, p. 1278; Sept. 13, 1913, p. 527. Mississippi River Power Company, April 5, 1913, p. 715; May 31, 1913, pp. 1157 and 1169. Lehigh Coal & Navigation Company, April 26, 1913, p. 903. Cedar Rapids Manufacturing & Power Company, April 26, 1913, p. 902; July 12, 1913, p. 105; Aug. 16, 1913, p. 319. Mexican Northern Power Company, May 31, 1913, p. 1190; July 19, 1913, p. 155. Chile Exploration Company, May 31, 1913, p. 1191. Sierra Electric Power Company, Sept. 20, 1913, p. 576. Sierra-San Francisco Power Company, Sept. 26, 1908, p. 667; Oct. 24, 1908, p. 985; Oct. 14, 1909, p. 946; June 1, 1912, pp. 1193 and 1195. Yadkin River Power Company, March 23, 1911, p. 748; April 20, 1911, p. 999; May 4, 1911, p. 1128; Aug. 5, 1911, p. 361; April 6, 1912, p. 774. Great Falls Water Power & Townsite Company, June 1, 1912, p. 1195. Central Colorado Power Company, Jan. 27, 1910, p. 217; June 23, 1910, p. 1649; June 1, 1912, pp. 1195 and 1205. Great Western Power Company, Aug. 26, 1909, p. 471; Sept. 16, 1909, p. 657; Sept. 23, 1909, p. 712; June 1, 1912, pp. 1193 and 1195; June 7, 1913, p. 1277. Southern Power Company, Dec. 28, 1907, p. 1241; March 24, 1910, p. 741; July 1, 1911, p. 17; June 1, 1912, p. 1195. Shawinigan Water & Power Company, May 4, 1912, p. 953; May 11, 1912, p. 1015; June 1, 1912, p. 1195. Los Angeles Aqueduct Company, Feb. 10, 1912, p. 301; May 3, 1913, p. 955. Tata Hydroelectric Company, June 14, 1913, p. 1332; Nov. 8, 1913, p. 950.

Use of Electricity in Mining Operations

Abstracts of the papers read at the Pittsburgh meeting of the American Institute of Electrical Engineers and of the discussions thereon

LAST week's issue of the *Electrical World* reported the meeting of the American Institute of Electrical Engineers held at Pittsburgh, Pa., on April 9 and 10, under the auspices of the committee on the use of electricity in mines and the Pittsburgh Section of the Institute, and noted briefly the discussion upon foreign and American regulations for electrical installations in mines. Following will be found abstracts of the papers presented at the meeting and of the discussions thereon.

Mine-Duty Controllers

Owing to the absence of the author of the first paper presented, it was read by Mr. Walter C. Kennedy, Pittsburgh.

This paper, by Mr. Harrison P. Reed, pointed out the peculiar conditions under which electrical apparatus has to operate in mines and suggested the types of control equipment which should be employed to give safe and reliable operation in that service. In selecting the control equipment for mine apparatus careful consideration should be given to the following points: Presence of explosive dust and gases, continuity of operation, voltage fluctuations, and dampness.

The speed of direct-current motors can be easily changed by varying the shunt-field current, but the method of varying the resistances in the secondary circuit of an induction motor to change the speed is open to serious objections because of rheostatic losses and decreased efficiency. Commutating-pole, slip-ring and squirrel-cage motors are not desirable, because of complexity of construction in the first case and poor starting characteristics in the second.

A system of speed control employing a motor-generator to supply an adjustable frequency below that of the main circuit was recommended as being exceptionally efficient. It is advisable from a safety and economic standpoint to employ self-starting motors on these sets. By installing auxiliary feeders to the motors which will prevent voltage fluctuations, many of the control complications can be avoided.

Mine pumps are generally installed within the mine to reduce the suction head, hence the control equipment should be designed to withstand moisture but need not necessarily be explosion-proof as it is generally at a distance from the mine workings. An inclosed switch for use where explosions are possible was described. With this device the motor acceleration is governed by limiting the current peaks with series-wound switches.

In discussing mine locomotives, it was pointed out that there is a tendency to eliminate overhead trolleys where there are low ceilings and to use storage battery energy or a trailing cable kept taut by a tension reel. If batteries could be automatically charged without delay by operating the locomotives periodically on trolley sections, the present objections to this type of locomotive would probably be eliminated. The nickel-iron battery, which seems most popular in mine service, shows its maximum efficiency when thus periodically boosted.

As acceleration is the important consideration in vertical mine hoisting, variable-voltage-control systems are preferable. Hoisting apparatus was described consisting of a shunt-wound motor receiving energy from a flywheel motor-generator. In conclusion the paper pointed out that there is a tendency to design motors for drilling and coal-cutting apparatus which may be connected directly to the supply lines without starting devices. Mine terminal boxes should preferably be designed so that contact between the plug and socket is made in oil. When an overload occurs the plug should be thrown out automatically. Types of series-parallel locomotive controllers, inclined tramway motor controllers and travel-limit devices were briefly discussed.

Discussion

Among those discussing the paper were Messrs. C. E. Waxborn, Columbus, Ohio; F. L. Stone, Schenectady; Sidney G. Vigo, Chicago; A. S. Biesecker, Scranton, Pa.; Graham Bright, H. H. Clark, H. D. James and W. M. Hoen, Pittsburgh. The effect of gas in switch oil, the carbonization of contacts and the frequency with which a mine switch operates as compared with one in an installation above ground were discussed.

Mr. Stone called attention to a case in which an oil switch was operated 388,000 times without any bad results. He added, however, that there is a difficulty in securing a perfectly air-tight switch.

Mr. Bright pointed out that since mine owners must of necessity pay more for experienced labor than railway and industrial concerns self-starting direct-current motors are especially desirable in mine service as a means of reducing the labor expense. The speaker said it would be more desirable to use a railway-type controller if one could be designed to fit into the limited space available on a mine locomotive. As a rule a mine motorman will not use the series connection for starting unless he is compelled to do so, a fact which should be borne in mind when designing mine controllers. The speaker said that in most cases a change from steam to electric drive has increased the economy of operation.

Mr. Clark, in answer to an inquiry, stated that some tests made by the Bureau of Mines on 250-volt, 100-amp oil switches showed that ignition would not take place with the switch surrounded by an explosive mixture of Pittsburgh gas and air. During the experiment each switch was operated 75,000 times under these conditions. He expressed the opinion that an oil switch can be made explosion-proof if the parts are properly proportioned, but it is questionable whether explosions can be prevented when the oil deteriorates.

Mr. James pointed out that, when necessary, the motor equipment can be modified to suit the control system adopted.

Mr. Waxborn did not appear to favor the use of oil switches for controlling coal cutters because there is a tendency for miners to pour any kind of oil into the switch cases when they need refilling. He mentioned a scheme that has been tried successfully in starting and stopping a motor-driven machine employing a form of friction drive which permits running the motor continuously.

Mr. Hoen recommended wound-secondary motors for driving fans, especially where the starting current must be limited. When a large speed reduction is necessary considerable energy loss occurs in the resistors, but it is not so great as if the motor were driving a constant-torque load. A two-speed squirrel-cage motor is satisfactory where only one speed reduction is required, since the control is simple and the starting characteristics satisfactory. For driving pumps simplicity is secured by using self-starting direct-current motors which may be thrown directly on the line. Motors of this type are now available up to 20 hp.

Self-Contained Portable Electric Mine Lamps

It is only since the carbon-filament lamp has been superseded by the tungsten lamp with its lower unit energy consumption that storage batteries have become light enough for practical use with portable electric mine lamps. Mr. H. O. Swoboda pointed out in his paper that an electric mine lamp must meet the following requirements: Absolute protection against ignition of mine gases; uninterrupted supply of light for at least one shift; simple, durable and foolproof construction; light weight, and facilities for charging and inspecting the battery. Experiments have shown that an exposed glowing filament will ignite mine gases, but sparks caused at a switch contact will not do so as long as the maximum short-circuit current of the battery does not exceed 100 amp at 2.5 volts or 45 amp at 6 volts.

A portable lamp should be protected against tampering and should be capable of burning in any position as well as when immersed in water and even after being dropped on hard objects. Several types of lamps meeting most or all of these requirements were described. One of those mentioned is equipped with an inclosed fuse which blows the moment the bulb breaks, thus preventing the ignition of mine gases. The battery can be removed only in the charging room by means of a strong electromagnet which acts on a magnetic lock. Special means is provided for allowing the battery gases to escape without permitting the acid to leak out. Attention was called to a special alloy which is being used in flexible-cord conductors connecting portable batteries with a cap lamp. If a short-circuit occurs, the conductor will fuse and interrupt the circuit without causing an explosion when surrounded by inflammable gases. Special racks for charging a large number of portable mine batteries at one time were described. In these racks the batteries are charged in multiple groups of forty batteries in series.

Investigation made in a large English colliery using more than 10,000 electric lamps showed that with careful supervision only about 1.5 per cent of the lamps used in each shift developed defects. Of this amount, 0.6 per cent burned at reduced intensity, 0.2 per cent had broken filaments, 0.2 had broken bulbs, 0.1 per cent had leaky batteries, and 0.3 per cent of the batteries discharge too quickly.

Experience in Europe indicates that the first cost of electric lamps is greater than that of benzine lamps, but the cost of operation, including maintenance, is 10 to 15 per cent lower for the electric lamps. Lead-battery electrodes last about 100 to 400 shifts, depending on the treatment received. Claims have been made that alkaline cells will last 2000 shifts, but according to the author this statement requires verification. The average life of mine lamps is about 1000 hours; about 0.1 per cent are lost by rough handling.

To attract attention to the rugged construction of some portable mine lamps the author threw a number of samples on the floor without damaging them in the least.

Discussion

Discussion of the paper was participated in by Messrs. H. H. Clark, H. H. Smith, Orange, N. J., and R. R. Burrows, Cleveland, Ohio.

Mr. Clark said that for mine service a lamp is needed which does not require an excessive amount of repairs or replacements and which is equipped with an exceptionally good battery. He pointed out that manufacturers have so far given little attention to increasing the life of a lamp bulb, which is just as important as the life of a filament. Lamps made by foreign manufacturers have shown a life of from 500 to 1000 hours. As the electric cap lamp is now more in demand than the hand lamp, special attention should be paid to designing the flexible cord connecting the lamp with the battery, so as to minimize its weight and prevent abrasion. The light from mine lamps should be distributed evenly and should be free from dark spots and sharply contrasting areas of bright and faint illumination.

Mr. Smith called attention to the fact that 20 per cent of the operating expense of mine lamps is for the battery repairs and renewals and 15 per cent is for attendance. He expressed belief that the use of alkaline batteries would tend to reduce these expenses.

Mr. Burrows spoke of a new primary cell which he tested and found to compare favorably with the lead cell in weight and discharge rate. The cost of charging was low and the maintenance not very great. He also mentioned a paste-electrolyte cell which is not subject to so large a voltage decrease during discharge as the liquid-electrolyte cell. Mention was made of a cell containing sawdust saturated with sulphuric acid which is inexpensive and should meet the requirements of a service where batteries are subjected to rough usage. Small batteries have an efficiency of only about 50 per cent and the fixed charges are high owing to rapid depreciation of the cell. When the ratio of the total fixed charges to initial cost is eight to one the most economical life is 300 hours instead of 1000 hours. Increasing the life to 1000 hours requires a 40 per cent increase in ampere-hour output of the battery and from 30 to 40 per cent increase in battery weight and cost.

Mr. Swoboda stated, in closing, that the candle-power referred to in his paper as being required in mines was measured without a reflector and the life records were reported by special investigators appointed by the Prussian government.

The Development of the Electric Mine Locomotive

Mr. G. M. Eaton's paper traced, largely by means of pictures, the development in locomotives for coal-mine service. The two main factors which have influenced their present design are the demand for increased entry capacity and the exploitation of thin seams. Since 1896, when the first electric locomotive was placed in this service, the block displacement has been reduced from 3.88 cu. ft. to 1.54 cu. ft. per hp. It was pointed out that mine locomotives should be designed to withstand severe collisions, sustain slight damages from falling roofs, and so that repair work can be done in a blacksmith shop. For welding broken parts quickly and effectively the author recommends the electric or Thermit process.

To meet the demand for a high drawbar pull with a minimum-weight locomotive, the wheels may be coupled with side rods, chains or gears and driven by one or more axle-drive motors. When a single motor is employed, however, the advantage of series-parallel operation is sacrificed. Tractive adhesion and the life of the wheels have been increased by the introduction of steel-tired wheels. Some four-axle-drive mine locomotives are now being equipped with two controllers, one controlling all four motors and the other only two. This

arrangement permits of operating the motors at their best efficiency, depending on the load, and allows flexibility of operation in case of injury to any one of the units.

The author urged against the employment of track-return and overhead-trolley circuits for operating gathering locomotives in mine rooms, suggesting the use of storage batteries or insulated cables wound on motor-operated or spring-retrieving reels as better practice. Since mine locomotives have little opportunity to coast and polish their commutators, sparking at the brushes should be prevented as far as possible by employing commutating poles.

Discussion

The paper was discussed by Messrs. F. L. Stone, W W. Miller, Schenectady, N. Y.; Charles W. Beers, Wilkesbarre, Pa.; W. A. Thomas and N. W. Storer, Pittsburgh. Ventilation and safety were discussed quite fully, but there was considerable difference of opinion as to how to obtain the best results. It was brought out that ball bearings are not satisfactory on mine locomotives because they become unsymmetrical by wear.

Mr. George Shapter, Schenectady, N. Y., declared that if satisfactory and economical results are to be obtained from storage-battery locomotives considerable attention will have to be paid to laying the rails evenly. He quoted 4 cents per ton-mile as the operation cost of a certain installation with which he was acquainted. The speaker declared that the storage-battery locomotive is not so efficient as the trolley locomotive, but it has a reason for existence.

Mr. Storer pointed out that while ball bearings permit the use of a smaller air-gap, they are not always desired, since the efficiency is reduced thereby. The air gap should always be such as to give good commutation and should not be determined by other conditions.

Mr. Eaton recommended solid gears in preference to the split type and expressed belief that case-hardened gears will be used more extensively in the future. The storage-battery locomotive, he believed, is doomed to failure unless the conditions under which it has to operate can be very materially bettered.

The two papers on mine substations were presented and discussed together.

Mine Substations

The installation, operation and maintenance of coal-mine substations were discussed in Mr. H. Booker's paper. A substation can generally be placed at a more advantageous position relative to the mine than can a private steam plant, as the former does not require coal or water for its operation. As the mine is enlarged and the output increased additional operating energy can be furnished quickly and cheaply by installing larger transformers and rectifying apparatus, or both. When energy is not required, there is practically no upkeep charge such as exists with a station requiring a boiler plant. When the station is operating the attendant is required to perform only such simple functions as closing switches, etc.

In general, a substation should be installed above ground and preferably near the pit mouth, so that it can be attended by a man who has other duties to perform. The fan attendant, tipple foreman or hoist engineer can generally look after the substation. In large mines the substation should be situated near the center of distribution to minimize the first cost of copper feeders. When the feeders cannot be run into the mine through one of its openings bore-holes can be employed.

Among the objections to installing a substation below the surface are danger of fire, presence of moisture, and poor ventilation of apparatus. When it is necessary to employ an underground installation, provision should be made for ventilating with intake air, and the high-tension cable should, when possible and practicable, be run through the intake airways. To guard against roof failure arched or reinforced-concrete ceilings should be employed and the entire structure made fireproof. For a 200-kw substation the dimensions should not be less than 24 ft. by 24 ft. by 12 ft. Cables leading from the surface to the underground equipment may be inclosed in lead-covered cables attached to a messenger wire about every 30 ft. by wiped joints or clamps. All machine frames should be grounded. Many accidents are caused by incompetent employees, hence good salaries should be paid to secure good attendants. To prevent accidents danger warnings should be posted liberally and conspicuously about the mines, indicating the presence of electrical equipment.

Mine Substation Motor-Generator Sets Versus Synchronous Converters

The paper by Mr. Will M. Hoen pointed out the relative characteristics of synchronous converters and motor-generator sets driven by induction and synchronous motors. Considered from their starting characteristics, these machines were ranked in the following order of desirability: Induction motor-generator, synchronous motor-generator, and synchronous converter. An induction motor has a small air-gap and hence operates with a lagging current which is detrimental to voltage regulation. A synchronous motor, on the other hand, has a large air-gap, and the power-factor can be easily controlled, thereby benefiting voltage regulation and avoiding penalization by the electric-service company for taking lagging currents. It is not generally economical, however, for a consumer to maintain higher than 90 per cent power-factor. A synchronous converter has a large air-gap, consists of only one unit, is much lighter per kilowatt output than the other two types of rotary machines, and requires less energy for starting. On the other hand, it is not adapted to simple power-factor correction through a wide range.

Discussion

Mr. Thomas said that while a rotary converter is more efficient than a motor-generator set, the use of the former will not greatly increase the total plant efficiency. The motor-generator is generally more popular in extensive coal fields where energy has to be distributed a considerable distance, since the generator can be over-compounded to make up for line drop.

Mr. P. M. Lincoln pointed out that the rotary converter is desirable when conversion from alternating to direct current is the only question, but this machine does not permit of much over-compounding; hence a motor-generator must be used when this feature is desired.

Mr. O. S. Newton, Columbus, Ohio, described a circuit-breaker which cannot be closed while a short-circuit exists on the line. The device also protects against fire, limits the current and regulates the control of a motor in its circuit.

Mr. N. Stahl, Pittsburgh, spoke briefly on over-compounding rotary converters and discussed the advisability of correcting power-factor by changing the field excitation of the converter.

Mr. Stone brought out the fact that with a rotary converter operating from a high voltage line it is often necessary to employ two banks of transformers on account of the large ratio of transformation necessary in obtaining the proper rotary voltage.

Mr. Hoen, in closing the discussion, said that underground substations should be avoided where possible.

Meeting of the American Electrochemical Society

Summaries of a number of the papers that were read at the session of the society held at New York City last week and of the discussions that followed their presentation

THE American Electrochemical Society met in annual session in New York April 16 to 18 inclusive. The sessions were held at the Chemists' Club and Columbia University. Routine business occupied part of the time of the first session, after which there was a symposium on power problems in electrochemistry.

Mr. P. W. Sothman spoke on power transmission and transmission economics, particularly with reference to electrochemical industries. He discussed the methods of generating electrical energy, dwelt on the transmission problems which must be considered in providing for the economical utilization of the energy, referred to some important structural design features, and gave general power-generation costs at different voltages. A more detailed report of this paper will be published in a subsequent issue of the *Electrical World*.

Dr. C. P. Steinmetz's topic was "Characteristics of Electrical Energy as Affecting Chemical Industries." He pointed out that where practicable it is advisable to locate chemical industries near nature's stores of energy in order that the power may be utilized to the best advantage. Near coal mines it is possible to generate energy for as small a sum as 0.01 cent per kw-hr., while hydroelectric energy cannot be developed for less than about 0.1 cent per kw-hr. Where central-station energy has to be employed Dr. Steinmetz suggested that the operations of a chemical industry be arranged to use off-peak energy, thereby obtaining lower rates than might otherwise be secured.

In commenting on the advantages of employing electricity for producing chemical changes instead of the heat of combustion, the speaker said that a higher temperature can be obtained by electricity than by burning coal or oil, consequently making it possible to reduce many ores that could not be worked by any other method. The ease of controlling the temperature of a furnace more accurately when using electricity was pointed out as another advantage. Moreover, electricity can be transmitted, distributed and converted into other forms of energy very economically.

As electrical energy cannot be stored except in small quantities, the cost of power is dependent on the rate of consumption. The power cost in an electrochemical industry operating on a twelve-hour schedule with electricity produced by burning coal is about 50 per cent greater than if the plant were operated twenty-four hours a day. Operating only one hour of the day costs about thirteen times as much as twenty-four-hour operation as regards energy used. When employing energy developed by water-power the ratio is different, because the fixed charge is practically the only expense in a hydroelectric plant.

When it is not possible to arrange operation to take advantage of the off-peak energy Dr. Steinmetz recommended operating an electrochemical plant at a constant electrical load without peak demands to secure the lowest energy rates. He also recommended using reactors in series with electric furnaces to prevent fluctuations in load and correcting the power-factor by floating synchronous motors on the circuit. This method, the speaker declared, is preferable to employing apparatus which has been designed to operate at high power-factor, as it is usually less expensive and answers the purpose more effectively. Electricity supplied for lighting factories is more expensive than that furnished for power purposes because of the poor load-factor.

The possibility of storing water in hydroelectric developments for twelve-hour instead of all-day operation was brought out, but it was declared that it would be less expensive to operate twenty-four hours a day, because the first cost of the generating plant would be less. In closing, Dr. Steinmetz emphasized the fact that electrical energy can be obtained at the least expense when the period of supply is chosen by the producer of the energy.

Mr. F. A. J. FitzGerald discussed some of the methods of obtaining economy in electric-furnace operation. He recommended examining power contracts very carefully before signing them. When the load is constant the rate offered is generally reasonable, but when energy must be supplied for peak demands the rate is generally raised with the primary charge based on the average of the intermittent peaks. He also called attention to the common practice of penalizing consumers if the load is not equalized on each phase of a three-phase system. It is not always advisable to employ the most electrically efficient apparatus, as it runs into money. The speaker pointed out that continuous operation has in many cases stunted the efforts to utilize off-peak power. Mr. FitzGerald advocated the use of apparatus for regulating the power delivered to electric furnaces, saying that it will often pay for itself by eliminating peak demands on which there is usually a very high rate. In addition, the use of regulating apparatus has often increased the output of furnaces as much as 10 per cent. In closing, he pointed out steps for obtaining economy and warned against exaggerating the importance of using highly efficient apparatus.

Mr. Robert Turnbull spoke on electric-furnace regulation and called attention to the advantages which may be obtained by employing automatic regulators instead of hand regulation. The labor expense may be decreased about 25 per cent to 30 per cent by employing automatic regulation, peak demands will be eliminated, and the product obtained from the furnaces will be more uniform. The speaker gave a detailed description of the Thury regulator, which is being used extensively in Europe and which has been employed in this country about five years.

Discussion

In the discussion Mr. M. Pettinot, Niagara Falls, N. Y., said that by using Thury regulators the cost of energy can be considerably reduced, as the power required is more constant and consequently there is no penalizing for peak demands.

Mr. C. A. Hansen, Schenectady, N. Y., called attention to the wave distortion caused by electric furnaces operating at light loads, saying that the power-factor is considerably reduced thereby. He also criticised the policy of some electrical concerns taking advantage of the lack of electrical knowledge of some electrochemical

operators to sell them apparatus which is not required by the industry and which does not perform the work ascribed to it.

Mr. F. A. Lidbury, Niagara Falls, N. Y., spoke on the complexity of electrical problems which are encountered even in the simplest electrochemical operations and called attention to the need of expert and reliable advice on these subjects. As from 20 hp to 100 hp is required in electrochemical industries per employee hired, the energy cost is very important, and there is danger in the smaller plants adopting the practice of larger concerns rather than considering the particular conditions applying to the specific case.

Dr. Steinmetz, Schenectady, N. Y., said that reactors in series with furnaces are inherently inductive but that they reduce the wave distortion caused by the electric arc and thereby increase the power-factor. Besides having this advantage, reactors prevent power fluctuations and balance the loads on a three-phase system. He added that it is bad practice to connect the neutral of a furnace to the neutral of a transformer installation when three-phase furnaces are employed.

Mr. P. M. Lincoln, Pittsburgh, Pa., pointed out that a power-factor meter does not measure the true power-factor when the waves are distorted.

Mr. Sothman, New York, described a power contract used in Canada which permits reducing the energy expense from 22 per cent to 24 per cent if a constant load is maintained during the year except at peak-demand periods of the supply system.

Mr. Robert Turnbull, Welland, Ontario, Canada, declared that it is not practicable to run furnaces off peak, since in the interest of economy they should operate continuously. If the power is shut off from a furnace for a certain period, the furnace will cool and must be brought up to the original temperature again, requiring a reheating period about equal in length to the cooling period.

Dr. Carl Hering, Philadelphia, Pa., suggested increasing the rate of production in electrochemical industries during off-peak periods to tide over the peak-demand periods, in that way taking advantage of the lower rates for energy.

Three papers read at the Jan. 9 meeting of the society and abstracted in the Jan. 17 issue of the *Electrical World* were presented at this meeting for the second time to invite discussion. The papers are as follows: "Sources of Direct Current for Electrochemical Processes," by Mr. F. D. Newbury, and two papers having the same title, "The Power Problem in the Electrolytic Deposition of Metals," by Messrs. Lawrence Addicks and H. E. Longwell respectively.

Owing to the absence of Mr. W. S. Horry his paper on "Power for Electric Furnace Works" was read by title.

On Thursday afternoon there was an experimental lecture on electrolytic flames, by Mr. W. D. Bancroft. This was followed by the reading and discussion of papers by Messrs. C. A. Hansen and E. B. Clark.

Electric Steel Castings

Operating data and characteristics of a 2-ton electric furnace employed by a steel-casting company at Easton, Pa., were presented in the paper by Mr. C. A. Hansen. The furnace is operated on 85-volt, sixty-cycle energy stepped down from 2200 volts. Direct-current motors regulate the position of the electrodes. The cost of melting metal in this furnace has been about one-half of what it was in the old crucible furnace which was displaced and was heated by oil costing 2.5 cents per gal. Since the advance in the price of oil, it costs $6 to $7 more per ton of molten crucible steel than formerly.

Electric-steel castings can be made with a lower percentage of carbon than crucible steel, but the cost of production increases rapidly with a decrease in the carbon content. Steel containing as low as 0.10 per cent carbon cannot be produced economically. It is not usually advisable to preheat the metal for charging an electric furnace, as the energy consumption per ton of output is greater than when a cold charge is used. The original cost of metal preheated in a cupola was about $18 per ton, as compared with $12 per ton for cold charging. Preheating an electric furnace with oil costing 2.5 cents per gal. until the charge is at red heat increases the cost of production about $1 per ton over the price of steel made by an all-electric process. Considering cost of production alone, continuous operation of an electric furnace means from 10 to 15 per cent saving over intermittent operation, but the decreased efficiency of night labor in other departments of a foundry may offset this saving.

Mr. Clark's paper compared various types of electric furnaces with other apparatus for producing or refining steel as to quality of output and cost of operation. The paper also brought out the best types and sizes of furnaces to employ for different installations.

In the discussion the following took part: Messrs. H. D. Hibbard, Plainfield, N. J.; E. P. Humbert, Niagara Falls, N. Y.; K. G. Frank, New York; Henry Hess, Philadelphia, Pa.; C. A. Hansen, Schenectady, N. Y.; J. W. Richards, South Bethlehem, Pa.; C. G. Schluederberg, Pittsburgh, Pa.; E. L. Crosby, Detroit, Mich.; W. D. Mainwaring, Cleveland, Ohio, and E. F. Cone, New York.

Mr. Hibbard suggested operating furnaces in pairs alternately, so that energy is on each only half the time, and employing oil burners to preheat the charge. By this arrangement the advantage of oil heating can be obtained without changing the electrical load on the entire system.

Mr. Hansen said that power fluctuations occurring when a furnace is being started can often be prevented by putting lime and fluorspar in the furnace. He does not believe that it is necessary to install flywheel generators to compensate for fluctuating loads.

Mr. Richards said that at Easton, Pa., the energy charge for operating electric furnaces is 1 cent per kw-hr. and the power is available all except one hour each day.

Mr. Crosby said that the Detroit Edison Company is doing all in its power to attract electrochemical industries by offering a maximum rate of 0.75 cent per kw-hr. The company's greatest difficulty is in obtaining suitable furnaces. The central-station company is willing to correct the power-factor itself by installing synchronous converters. A new rate is now being considered for off-peak business which will apply to the entire territory served by this company. The new rate will make it possible to save from 15 per cent to 30 per cent of what is now being paid for energy. A flat rate of $51.30 per kw-yr. for constant-load demand is now in effect.

Mr. Cone declared that the use of electric furnaces makes refining a simpler operation and permits of regulating the physical properties of the steel more accurately than by any other method.

Advantages of Southeastern Alaska for Hydroelectrochemical Industries

The paper by Mr. W. P. Lass called attention to the opportunities for hydroelectrochemical developments in southeastern Alaska by pointing out the natural power resources and crude manufacturing products available there. Vast coal deposits in the western part may be utilized in firing boilers, and the rainfall, which is exceedingly heavy, makes it possible to develop hydroelectric power economically. Water rights may be obtained for periods of fifty years, subject to renewal, upon payment of a fee not exceeding $1 per hp-yr. Lakes situated in

rock gorges with narrow outlets at altitudes of 1000 ft. afford natural means of conserving the precipitation and equalizing the flow during the year. The rugged character of the country makes long transmission difficult and expensive, however, so that it is advisable to utilize the energy at the place where it is developed. The entire country is open to navigation at all times of the year, making it a simple matter to receive and ship materials. Crude California oil with an asphaltum base may be obtained for $1 per barrel in Alaska.

Other papers presented at the afternoon meeting were "Improvements in the Metallurgy of Zinc," by Mr. G. C. Stone, and "Electric Zinc Smelting," by Mr. W. R. Ingalls.

On Thursday evening Dr. E. F. Roeber delivered his presidential address on "Some Economic and Esthetic Aspects of Electrochemistry." His discussion dealt with the time, place and form value of electrochemical products and the effect that modern engineering has had on the esthetic senses. Electrochemical products always have high form value; by transportation to some place where their energy content may be extracted they acquire place value, and by deriving their energy content when it is needed they get time value. Through electrochemical processes what was formerly waste material has become valuable. Modern engineering has extended the natural senses of the human being by furnishing artificial senses in the form of instruments and apparatus.

Friday was devoted to inspecting electrochemical industries in the vicinity of New York, trips being made to the works of the American Smelting & Refining Company, the United Lead Company and the Waclark Wire Company.

The presentation of papers and discussions was resumed on Saturday, the sessions being held at Columbia University.

Electrochemical Extraction of Copper Ore on Large Scale

Mr. E. A. Cappelen-Smith gave an interesting talk on the "Progress in Leaching and Electrolytic Treatment of Copper Ores in South America." He described a copper refinery located at Chiquicamata, Chili, which is capable of handling 10,000 tons of ore per day. The impurities in the ore used do not interfere with electrolysis, but chlorine, which is the major impurity, is removed by treating the ore with cold sulphuric acid and passing the solution through shot copper, which becomes coated with cuprous chloride. About 9 lb. of sulphuric acid per ton of ore must be used in leaching, but the composition of the ore is such that the sulphuric acid is automatically replenished by chemical change.

Five hundred and ten electrolytic tanks are installed at the plant, thirty being used for making cathode plates and the rest employed in extracting the copper from the electrolyte. The tanks are made of reinforced concrete lined with 1.5 in. of mastic Trinidad asphalt in which there has been mixed crushed quartz and granite. It is said that the lining is unaffected by the chemical action in the cell. Magnetic oxide of iron anodes, which are about 4 ft. long and 4 in. wide, are used in these cells. The anodes are hollow and copper-plated within to increase their conductivity. Five units are placed in each tank. It is declared that these anodes do not depreciate because they are not subjected to electrochemical action; hence their life depends on the care with which they are handled. Copper obtained by melting the cathodes produced in this plant has 100.26 conductivity compared with the Matthiessen standard.

Electricity for operating this plant is generated in a station about 85 miles away and is transmitted to the electrochemical works over a 100,000-volt transmission line. Installed in the generating station are oil-fired boilers and four 10,000-kw turbo-generators. At the delivery end of the line the energy is converted to direct current by five 2500-kw motor-generators.

In the discussion which followed Mr. Cappelen-Smith said that the uniform thickness of the copper cathodes obtained depends on the manner in which the interior of the anodes is copper-plated. The cathodes contain about 0.001 to 0.01 per cent of chlorine. The speaker declared that the anodes contain about 3 to 5 per cent of silica, which serves as a binder for the Fe_3O_4.

A paper on the "Hydroelectric Treatment of Copper Ores" was next presented by Mr. Robert Rhea Goodrich. It contained a brief summary of several practised and suggested processes of extracting copper from its ores by electrical methods.

Among other papers which were delivered at this session were the following: "Leaching of Copper Tailings," by Mr. R. Gahl; "Metal Inventory in an Electrolytic Refinery," by Mr. R. W. Deacon; "Electrolytic Zinc," by Mr. J. W. Richards; "Addition Agents in the Deposition of Zinc from a Solution of Zinc Sulphate," by Messrs. O. P. Watts and A. C. Shape; "Electrodeposition of Cadmium," by Messrs. F. C. Mathers and H. M. Marble; "Electrodeposition of Nickel," by Messrs. C. W. Bennett, H. C. Kenny and R. P. Dugliss; "Electrolytic Deposition of Brass on a Rotating Cathode," by Messrs. C. W. Bennett and A. W. Davison, and "A New Method for the Determination of Free Cyanide in Electroplating Solutions," by Mr. G. E. F. Lundell.

The afternoon session was opened by an experimental lecture on "Electric Conduction at High Temperatures and Methods of Measurement," by Dr. E. F. Northrup, of Princeton University. He pointed out that the sharp distinction which is generally drawn between conductors and insulators exists only at normal temperatures and not at the higher temperatures. Curves were shown indicating the variation in resistivity of several pure metals, some oxides and brass at temperatures as high as 1500 deg. C. Of the metals tested all except bismuth and antimony showed a sudden increase in resistance in passing from the solid to the liquid state. In general, the ratio of the resistances just before and after fusion is roughly two. With the exception of zinc, cadmium and antimony the increase in resistance is practically a linear function of the temperature, while with gold and copper it is exactly linear. Methods of producing and measuring high temperatures were discussed and models of the new Northrup high-temperature furnace in which platinum may be melted were exhibited and described. A "cascade" attachment was also described which can be placed in a furnace to melt tungsten or even carbon. Data were given showing that the ratio of the coefficient of resistance to that of cubical expansion is approximately constant for the metals tested when they are in the molten state. It was suggested that the cubical expansion of molten metals could be determined by measuring the resistivity of the metal at the particular temperature under consideration.

The meeting of the American Electrochemical Society was concluded by the presentation of the following papers: "Laboratory Notes on Some Electrical Properties of Silver Sulphide," by Mr. F. A. J. FitzGerald; "Polarization Single Potentials," by Mr. C. N. Hitchcock; "New Cell Arrangements for Direct Determination of the Free Energy," by Mr. R. Beutner; "A New Railway Track Cell," by Mr. E. L. Marshall; "Experiments on White Lead," by Mr. R. S. Owens; "A Microscopic Study of Electrolytic Iron," by Mr. O. W. Storey, and "The Effect of Addition Agents in the Electrodeposition of Iron," by Messrs. O. P. Watts and M. H. Li.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

The Sun Never Sets on the Electric Vehicle

"At the present time the electric truck is used in more than 125 different lines of trade and in forty-one of the forty-eight states," commented Mr. F. W. Smith, vice-president of the United Electric Light & Power Company, New York, and president of the Electric Vehicle Association of America, in the course of a recent address at Washington.

"The electric vehicle has followed the sun around the world and is doing yeoman service in Canada, Cuba, England, China, South America, Turkey, Siam and Australia. Everywhere it is setting the pace in simplicity of design and operation. Electric trucks are cutting costs where hills are unknown, as well as in such hilly centers as Pittsburgh, Cincinnati, Kansas City and San Francisco. It is for these reasons of economy and efficiency that the 'electric' is favored by public opinion as the ideal vehicle for city and suburban haulage."

Window Displays of the New York Edison Company

The New York Edison Company makes its show windows serve two purposes—first, the displaying of electrical appliances and fixtures, and second, the instruction of the public as to how windows should be equipped electrically to attract the most attention. In one of its windows the company recently exhibited a motor-driven advertising mechanism which produced such fascinating ocular illusions and went through such peculiar movements that considerable attention was attracted to the movable central-station advertisements attached thereto. The device, which was called a "symmetroscope," consisted of a mirror-lined, pyramidal-shaped vessel which was rotated about its axis of symmetry by a small motor through gears and belting.

Attached to the rotating part nearest the observer were ten circular cards bearing snappy advertisements, and weighted so as always to remain in a vertical, or readable, position, even when the pyramidal-shaped vessel revolved. In the latter was some imitation fruit which was apparently tripled in quantity by reflections in the mirrored walls of the container. After every third revolution of the fruit container, a rack and pinion operated by a cam on the motor shaft caused the vessel to swing back through a vertical angle away from the window, at the same time allowing a small advertising curtain to unroll. Ten different curtains dropped automatically in the course of thirty revolu-

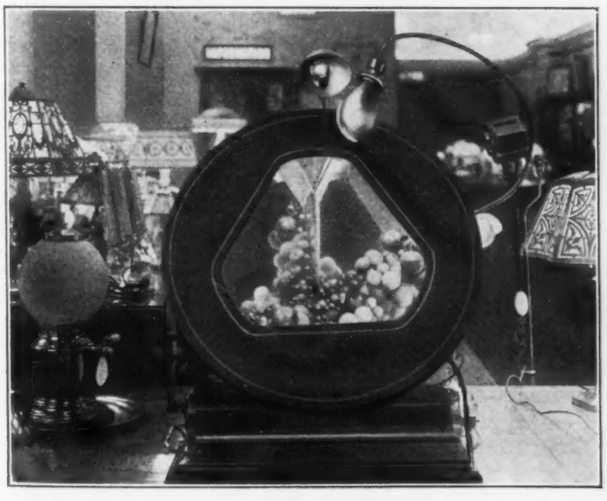


FIG. 1—MOTOR-DRIVEN SYMMETROSCOPE, SHOWING FRONT CONTAINER

The Public's Picture Gallery is The City's Streets

Your *show window* should be a masterpiece. People pause before a good picture well lighted. If your window can't make them stop consult our Bureau of Illuminating Engineering.

The New York Edison Company

FIG. 2—BULLETIN DISPLAYED IN CENTRAL-STATION WINDOW

Tell the Elevator Man—
"Third Floor Please
There we have the most complete collection of Electro-Therapeutic appliances exhibited anywhere
The New York Edison Company

FIG. 3—SYMMETROSCOPE TILTED BACK, DISPLAYING ADVERTISEMENT

tions of the container, each time rewinding again ready for the next advertising display to appear. This device is manufactured by the Publicity Experts' Association, 18 West Thirty-fourth Street, New York.

In another one of the electric company's windows, displaying several ornamental table lamps and electrical appliances, were placards, similar to the one reproduced herewith, presenting the advantages of electrically lighted show windows and advising customers to consult the Edison company's bureau of illuminating engineering for suggestions.

Village Closes Municipal Electric-Light Plant

Westerville, a town of 1600 inhabitants about 15 miles from Columbus, Ohio, has recently discontinued the operation of its 100-kw municipal electric-lighting plant and is now receiving service from the mains of the Columbus Railway & Light Company. Energy is delivered to the town at 13,200 volts and is sold to the town itself at a wholesale rate and retailed by the town to the former customers of the municipal company over the existing distribution system. For a portion of the distance the transmission line is carried on the poles of an electric-railway company but for the remainder of the distance a line of 50-ft. and 60-ft. poles has been erected.

An extension in the opposite direction from Columbus also has been completed recently so that Grove City, with a population of about 1000, is now receiving electric service.

Metered Versus Unlimited Service to Office-Building Tenants

Customers sometimes question whether the average public-service company furnishing electricity or gas is always sincere in its professed attitude toward waste. Interesting in this connection is the case of the modern office building, the consumption in which is usually sufficiently large to make it an important factor with the local electric company. There is a growing tendency toward giving the tenant the option between having his electricity metered to him or paying for it with other service in the flat rental charge.

By the latter plan, which in some sections is still the most generally used, the tenant is practically on a flat rate for his electricity. That is, a charge is included in his rental to cover the energy he uses, and this is in turn paid for by the owner of the building on a meter basis. Thus the tenant is free to use all the service he wishes, without the restraint imposed by the knowledge that he must pay for each hour his lamp burns or his fan is kept running. The result, therefore, is usually considerable waste.

In an office building where a majority of the tenants elect to have their service metered to them it is certain that less energy will be consumed than where a flat rate, inviting waste, is charged by the building management. The rate to all such buildings, it may be assumed, is the same, and hence the revenue from them is proportioned exactly to the relative consumption of energy. This would make it appear that the company gains nothing from the metering plan, but rather loses the sale of just so much service, without any corresponding advantage, unless it be in the form of increased good-will.

It has been found, however, that there is a decided advantage of the last-named character. One of the officers of a central-station company which has a number of buildings taking service and remetering to tenants declared recently that the owners of buildings purchasing energy on the old plan of unlimited service to tenants are nearly always among the most vigorous "knockers" of the central-station company because of their large bills, and this in spite of the fact that the tenants are to blame, and not the company.

Another decided advantage, which is pretty sure to operate as an affirmative business-getter for the company, is the fact that an office tenant taking service through his own meter and finding the monthly charge to be a trifling amount is not only pleased at the saving but will be impressed by the economy of electricity for various purposes.

This, again, means that in cases where the tenant having electricity in his office has never used it in his home the low bills received at the office are almost certain to result sooner or later in the installation of electricity in the home, thus adding another consumer to the central-station lines, which is the ultimate aim of the company and the justification of the modern policy of waste prevention.

"Do It Electrically" Slogan Bears Fruit in Iowa City

The slogan "Do It Electrically" is bearing fruit in Fort Madison, Ia. (population about 11,000), as shown by the number of electric signs which have been installed on the main street during a central-station sign campaign begun only a few months ago. Electric service has been furnished in this city since April, 1913,

NIGHT AT FORT MADISON, IA.

by the Fort Madison Electric Company, a Stone & Webster property. Before that time the power plant was operated in conjunction with a sawmill. Now energy is purchased from the Mississippi River Power Company and is transmitted to the city from Keokuk over a 11,000-volt line. The central-station company has equipped a modern office and an attractive electric shop in which to receive its customers.

Ice-Making Returns in a Central West City

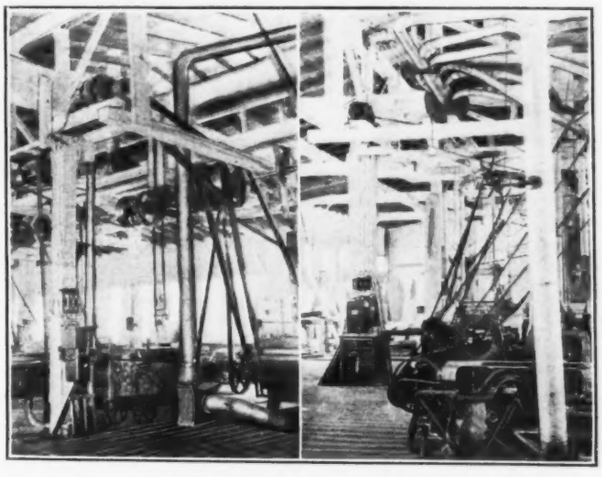
The ice factory owned by a combination ice-electric company in a city of 4000 population in one of the Central States consists of a 9-5-in. bore by 15-in. stroke ammonia compressor driven by a 10-in. by 30-in. Corliss engine. The condenser comprises two sections of 2-in. pipe, 20 ft. long and 24 pipes high, giving a total of 960 lineal ft. of 2-in. pipe. The freezing tank is 32 ft. long, 16 ft. wide and 4 ft. deep, with 3073 ft. of $1\frac{1}{4}$-in. expansion pipes. This freezing tank contains 160 300-lb. ice cans made of No. 16 galvanized iron and each measuring 11.5 in. by 22.5 in. by 45 in. Distilled

water is supplied by a "dog-house" condenser. The engine driving the ice machine supplies all the distilled water necessary. This water does not have to be reboiled, as it produces very clear water without other preparation. The ammonia compressor is normally rated at 10 tons output per twenty-four hours. A storage room capable of holding a reserve of 50 tons of ice is also cooled through the direct expansion of ammonia in 500 ft. of 2-in. pipe. Under the terms of the manufacturer's guarantee, 30 hp at the shaft, with condensing water at a temperature of from 60 to 70 deg. Fahr., will produce 10 tons of ice for twenty-four hours. The building was constructed about ten years ago for $1,500. The total investment in machinery, building, freezing tank, etc., amounted to about $10,000. During 1911, a good ice year, the total plant income from ice manufacture was $4,480, while for 1912, which will be remembered as a cool season, the return was reduced to $3,855.

Multiple Switching of Blowers in Motor-Driven Woodworking Plant

High first cost of the blower installation is often the factor which decides whether or not a woodworking plant can be equipped economically with motor drive. Sometimes a large blower capable of serving several machines is provided with a separate motor and arranged to operate continuously, although this plan increases the energy cost out of all proportion to the service rendered. A scheme recently tried out in the mill of the J. T. Weybrecht & Sons Company, Alliance, Ohio, in which the motor-driven blowers are connected on multiple-switching circuits, has proved quite satisfactory and also very economical.

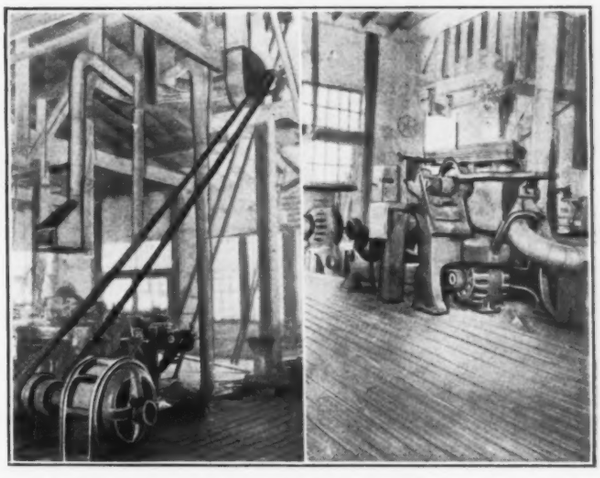
As will be seen from data in the accompanying table, each blower is arranged so that it serves a group of milling machines. On the circuits feeding the blowers for each group are multiple switches placed near the control apparatus of each milling machine, which enable the operators to start the blower just before beginning work on any individual machine. Should the



FIGS. 1 AND 2—MULTIPLE-BLOWER SWITCHES ON POSTS NEAR MACHINES

blower be in operation when a man closes his multiple switch, operation of the blower is unimpaired, and as long as any one operator is using a machine the corresponding blower continues in operation, being taken off the circuit when the last multiple switch is opened. It is a rule of the shop that each man must close the blower switch adjacent to the machine on which he wishes to work before beginning operation and must open it when the operation has been concluded.

Service for these machines is supplied from the distribution system of the Alliance Gas & Power Company through three 20-kw, 2300/220/110-volt transformers, energy being metered on the primary side of the circuit. Practically all of the motors in the shops



FIGS. 3 AND 4—TYPICAL MOTOR INSTALLATIONS; MOTOR BENEATH MACHINE

operate at 1720 r.p.m., so that units of the same horsepower rating are interchangeable. Shavings and sawdust from the woodworking machines are delivered through the blower pipe system to an overhead bin and are used in the furnace of a 100-hp boiler supplying live steam for a dry kiln.

In expressing his satisfaction with the new motor-driven installation, Mr. W. F. Heiff, foreman of the shop, declares that the present cost of operation is approximately one-third of that for the former steam-driven plant. Besides this, speeds are more steady and there is less noise. The Weybrecht company is engaged in general milling and employs sixteen men who work nine hours a day. The total connected load of the woodworking plant is 148 hp.

GROUP MACHINES IN WOODWORKING PLANT

	Motor Hp
Group No. 1:	
Smith & Phillips pulley mortiser; 8-in. jointer, T-slotted head	3
14-in. jig saw, 36-in. band saw	3
Double-spindle shaper	3
Horizontal-head panel raiser	3
Blower (25-in.)	5
Group No. 2:	
4-in. molder; 6-in. molder	10
24-in. pony planer	5
Blower (25-in)	5
Group No. 3:	
20-in. rip saw; combination No. 2 tenoner; American chain mortiser	5
16-in. jointer; 20-in. rip saw, Beech; sash and door mortiser, light	5
Blower (25-in.)	5
Group No. 4:	
48-in. drum sander and blower (20-in.)	20
Group No. 5:	
16-in. jointer; Beech rip saw	5
27-in. double surfacer	15
Blower (25-in.)	5
Group No. 6:	
8-in. molder; Berlin self-feed rip saw	10
Blower (25-in.)	5
Group No. 7:	
12-in. molder	20
Blower (30-in.)	5
Other Machines:	
Two turning lathes	3
20-in. swinging cut-off saw	2
Emery grinder	2
Tool-room utility motor-emery	3
Band-saw sharpener	1
Total	148

Illumination and Wiring

Sanitary District to Supply 1000 More Street Lamps for Chicago

The majority trustees of the Sanitary District of Chicago are reported to have assented to the wishes of the minority, and also to those of the majority of the City Hall officials interested in the subject, in promising to erect and maintain 1000 additional street arc lamps at the present rate for the city of Chicago. This number is to supplement the 23,000 now under contract. The rate is equivalent to 0.5 cent per kw-hr. The majority trustees desired to increase this to 0.59 cent, on the advice of Mr. Roy Palmer, the city electrician and Mr. E. B. Ellicott, electrical engineer of the Sanitary District. A long dispute waged around the question of the actual cost of producing and distributing the hydroelectric energy of the Sanitary District. Finally, it was agreed that the rate should not be increased, the additional lamps not to exceed 1000 in number.

1600 Inverted Magnetite-Arc Units at Providence

The city of Providence, R. I., is just completing the installation of 1600 inverted-type magnetite arc lamps in its business section and on the principal thoroughfares radiating therefrom, making one of the largest systems of the kind ever installed in an American city. Eight hundred of the lamps are carried on posts in the underground district, and the remaining 800 are supported on brackets on wooden poles in the outlying sections where overhead distribution is the rule. Posts, lamps and energy to operate the system 4000 hours yearly are furnished by the Narragansett Electric Lighting Company on the basis of $85 per lamp-year for units in the underground district and $75 per lamp-year for those carried on overhead brackets. These General Electric 5.5-amp arc lamps operate with a potential of 72 volts across the lamp terminals, and each burns about 120 hours per trim, making it necessary to replace electrodes only once every ten days or longer. As the mechanism is placed below the arc chamber, it is impossible for heat from the flame to warp the parts or bake the coils. The lamp-posts are staggered on opposite sides of the streets and in the business section are placed at intervals of 60 ft. to 90 ft. The two sides of a given street are fed from separate circuits so that in case of failure of one circuit the lighting of the section affected will not be entirely extinguished.

FIG. 1—BRACKET LAMP ON OVERHEAD SECTION

FIG. 2—UPRIGHT POST IN UNDERGROUND DISTRICT

In general the new Providence lighting system employs magnetite lamps on posts in the down-town section and along the principal streets leading out through the suburbs, bracket-type arc lamps on less important and more remote principal streets, and 60-cp tungsten incandescent lamps on the intervening and residential streets. Some 8000 of these overhead tungsten units are now being installed, for the operation of which the city pays $17 per lamp year. In addition, there are about 700 tungsten standards in the underground district for which an annual charge of $22 each is made.

FIG. 3—THREE-LAMP POST IN PUBLIC SQUARE

These 8700 tungsten units will ultimately replace all the former gaslight posts in the city, as it is found that the electric lamps are less expensive to maintain and require less trouble for their proper attention. Formerly the cost of lighting Providence's streets was $285,000 yearly. The new electric-lighting installation will cost but $260,000 yearly to operate, or $1.07 per capita, and compared with the former system of open-arc and gas lighting has twice the number of units, a better distribution and more diffuse illumination. Mr. R. L. Brunet is engineer of the Providence public service board.

Top Versus Bottom Connections for Meters

Following careful consideration of the subject of meter connections, the lighting department of the British Columbia Electric Railway Company, of Vancouver, B. C., has decided to alter its former policy regarding the use of the top-connected type of meters heretofore employed and will hereafter use "bottom connection" meters exclusively. Among the reasons for the change brought forward at recent departmental discussions on the subject were the following:

(1) Meters are very often installed in damp locations, and in such cases the top connection does not

afford as much protection for the equipment as the bottom connection.

(2) Requirements of the municipal electrical bureaus demand that meters shall ordinarily be installed at a considerable height. Under these circumstances it is difficult to inspect closely the contact points with the top connection. With the "bottom connection" the condition of the contacts can be seen from the floor at a glance.

(3) Should there be loose contacts and consequent overheating with the top connection, the melting of the terminal would result in the flow of the metal into the meter.

(4) With the use of the bottom connection it is comparatively easy to notice any attempt to tamper with the meter, since the connection is several feet lower down, is not concealed in any way and permits the inspection seal to be seen without trouble.

(5) Testing of the meter may be carried on with much less difficulty where the bottom connection is used.

The new policy of the Vancouver company will go into force very shortly and its contracts for meters will be based on specifications framed accordingly. All new meters placed will be of the new type and the top-connection meters now installed will be replaced as soon as their useful lives are ended.

Line-Construction and Cost-Keeping Methods at Milwaukee

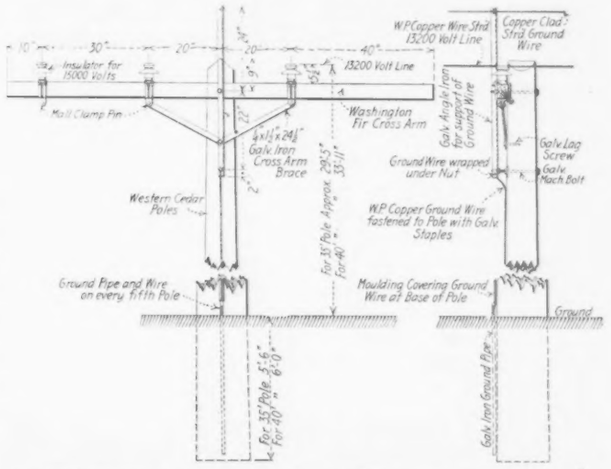
Exemplifying the high grade of line construction employed by the Milwaukee Electric Railway & Light Company, the 13,200-volt Watertown-Fort Atkinson transmission line, completed a short time ago, extends 28 miles from Watertown, a city about 47 miles west of Milwaukee, south to Fort Atkinson, serving the intermediate towns of Johnson's Creek, Jefferson and Lake Mills. The methods of preventing telephone disturbances, provisions for adding another circuit, means of insuring continuous service, methods of highway and foreign cross-over construction, and system of keeping construction costs, are among the interesting facts connected with this installation.

Watertown, which is the northern terminal and energizing source of the new 13,200-volt line, is also situated on a 40,000-volt, twenty-five-cycle steel-tower transmission line connecting the steam generating stations of the Milwaukee electric-service company with a hydroelectric plant at Kilbourn, Wis. Although energy is normally fed to Watertown from the hydroelectric plant, it will be possible in case of emergency to energize the new line from the Milwaukee extremity of the 40,000-volt line. A substation containing two 300-kw, 25/60-cycle frequency changers and one 300-kw waterwheel generator was installed at Watertown before the present 13,200-volt line was planned to supply energy for the local city service. To furnish electricity for the new line a 500-kw frequency changer has been added. This machine is fed from the higher voltage line through three 200-kw step-down, single-phase, oil-cooled General Electric transformers connected in delta on the high-tension side.

The line extending to Fort Atkinson consists of three No. 4 seven-strand hard-drawn copper wires supported on wooden poles, as shown in the accompanying drawing. Although only one circuit is installed at present, the insulators are arranged so that another set of equally spaced conductors may be erected in the future without reconstructing the line. This may be done by fastening the second cross-arm below the first one with the insulators arranged in the reverse order to that employed on the upper arm, thus providing positions for two sets of equally spaced conductors on each side of the pole.

Independent and Bell telephone circuits parallel the transmission line throughout practically its entire length, one system being on the same side of the road as the transmission line. To avoid disturbing communication over the telephone circuits the transmission line conductors were strung about 8 ft. above those of the telephone system, and a 0.25-in. copper ground wire is supported about 24 in. above the center line of the upper cross-arm on a vertical angle-iron and grounded at every fifth pole. At the main highway crossovers the poles are equipped with double cross-arms, guys and grounding connections. Where permission has been obtained the trees on each side of the right-of-way have been cleared away, leaving a minimum clearance of 5 ft.

Johnson's Creek, which is the first town south of Watertown supplied with electricity from this system, is equipped with a distributing substation from which the street-lighting circuits and residence service are supplied. Step-down transformers are installed outside the station on the 13,200-volt poles. Twenty-five 75-watt tungsten lamps are employed for street lighting. From this town two lines branch out, feeding


W.P.Copper Wire Strd 13200 Volt Line
Copper Clad Strd Ground Wire
13200 Volt Line
Insulator for 15000 Volts
Mail Clamp Pin
Washington Fir Cross Arm
Galv Angle Iron for Support of Ground Wire
Galv Iron Cross Arm Brace
Galv Lag Screw
Galv Mach Bolt
Ground Wire wrapped under Nut
Western Cedar Poles
W.P. Copper Ground Wire fastened to Pole with Galv Staples
Ground Pipe and Wire on every fifth Pole
Moulding Covering Ground Wire at Base of Pole
Ground
Galv Iron Ground Pipe

STANDARD POLE EQUIPPED FOR 13,200-VOLT TRANSMISSION LINE

Lake Mills and Fort Atkinson. On the pole where these lines originate are installed two sets of open-air Delta-Star pole-top sectionalizing switches, so that either of the aforesaid lines may be disconnected from the line leading north to Watertown. A man at Johnson's Creek has charge of the supervision and maintenance of the branch lines.

Two municipal lighting plants are supplied with energy from this system, one being situated at Lake Mills and the other at Jefferson. Lake Mills, which is a town of about 1700 population, is furnished with two-phase, 1100-volt energy by two T-connected transformers. Induction-type, single-phase voltage regulators are employed. About 100 kw is delivered to the municipal plant at Jefferson.

At Fort Atkinson three 75-kw transformers and four aluminum-cell electrolytic lightning arresters are installed supplying energy to an ungrounded 2300-volt, three-phase distributing system. There are large creamery package industries at both of the last-mentioned places.

While the line was in the process of construction the work was hastened by subdividing the job and employing several squads of men at different points along the right-of-way (instead of in a single group) to set poles,

erect cross-arms, string conductors, etc. As the line was not conveniently situated for receiving supplies by railroad, considerable long-distance hauling by wagon had to be done, which both raised the unit cost of line construction considerably and delayed progress.

Special itemized construction-cost records were kept on the job. Meals and lodging provided the workmen were recorded on one set, line-construction time reports on another, statements of total work done by the line-construction gangs on a third, and the entire data were segregated under different items on a fourth sheet. In the form covering work by the line-construction gang the work done by each man is itemized under the following heads:

Number post holes dug.
Number poles unloaded.
Number poles shaved and framed.
Number poles painted and trimmed.
Number poles distributed.
Number poles erected.
Number poles back-filled and tamped.
Number poles concreted.
Number cross-arms unloaded.
Number cross-arms delivered.
Number cross-arms placed.
Number insulators distributed.
Number insulators placed.
Pounds of No. 4 cable unloaded.
Pounds of No. 4 cable distributed.
Feet of ¼-in. ground cable unloaded.
Feet of ¼-in. ground cable distributed.
Pounds of No. 4 cable strung.
Feet ¼-in. ground cable strung.
Pounds of No. 4 cable tied.
Feet of ¼-in. ground cable tied.
Number splices made.
Ground-wire supports distributed.
Ground-wire supports erected.
Ground rods distributed.
Ground rods installed.
Feet of ground wire distributed.
Feet of ground wire installed.
Number deadmen installed.
Number guys installed.
Number trees trimmed.

In addition a record of the following items was kept: Time lost due to lack of material, waiting for orders and weather conditions; traveling time; maintenance of equipment; care of teams and wagons, and camp work. These records, together with tabulated petty expenses, rolling stock investments, rail charges, electric shop expenses and general utility charges, constitute data which will be extremely valuable to the engineering department of this company when making preliminary estimates on other work of a similar nature at any subsequent period.

Arc Lighting for Main Streets of Hammond, Ind.

Eighty-six ornamental luminous-arc lamps have recently been placed in service at Hammond, Ind., fifty-two of the units being installed on Homan Avenue and thirty-four on West State Street. The lamps, which

LIGHTING UNITS, HOMAN AVENUE, HAMMOND, IND.

are of the General Electric 4-amp luminous-arc type, are supported on ornamental iron posts made by the Morris Iron Works, Baltimore, Md. Posts are spaced 50 ft. apart on both sides of the street, being set opposite one another. Steel-taped cable incloses the conductor in the underground construction. In order to provide for future festivities in the city, lugs for holding flags have been cast on the ornamental posts at a point about 6 ft. above the sidewalk. One of these lugs may be seen on the post in the foreground of the accompanying illustration.

Electrical energy for the lamps is supplied from two fifty-lamp rectifier sets in a station of the Northern Indiana Gas & Electric Company, operating in Hammond and adjacent cities. The expense of the installation was borne by property owners, the amount, $102 per unit, being collected by special assessment. At present the lamps are operated from dusk until 11 p. m. The city pays $47 per lamp for energy and maintenance.

Recent Telephone Patents

The automatic-exchange impulse transmitter has been used for both wall and desk-stand telephone sets for a long time, but it has never been adopted to any great extent to the hand-microphone set with the transmitter at one end of a handle piece and the receiver at the other end. Mr. A. E. Keith, of Hinsdale, Ill., has now arranged such a set with an impulse sender attached, and he has obtained a patent for this apparatus, which is assigned to the Automatic Electric Company. The impulse-sending device is reduced to a size commensurate with the watch-case receiver, and it is mounted upon the opposite side of the handle from the receiver. The case is cylindrical and its base is secured to the handle concentrically with the receiver, the hand wheel being on the outer end of the casing.

Mr. Keith has also obtained a patent for an automatic exchange system for which he has devised a master switch for trunking. This patent is also assigned to the Automatic Electric Company. The contacts of the trunking apparatus are connected to trunk springs, which are so arranged that the contact wipers may be oscillated step by step before the springs. The oscillating wipers are driven by a shaft under control of a ratchet, the motion of which is unidirectional. The switch stops with its wipers before an idle trunk, one set of wipers being arranged in a vertical row for each incoming line. If a call arrives, the corresponding wiper is freed from the motor mechanism and thrust into the trunk terminals, whereupon all the other wipers are advanced until each confronts the next idle trunk. With this apparatus every step of the motor causes an effective motion of the wipers, and no quick-return step is necessary, as would be the case if the contact wipers stepped in one direction only.

Mr. E. E. Clement is the patentee of an automatic switch for automatic-telephone systems, his patent being assigned to the Clement International Engineering Corporation. According to this system the contacts are arranged on edge in vertical rows on a cylindrical surface. Thus the wipers take their horizontal rotary motion first and the vertical linear motion last. The elevating rack or ratchet is a bar attached to a sleeve which does not rotate with the shaft. Another novelty lies in the fact that all armatures are arranged to swing on knife edges rather than on pins or pivots.

An automatic system has already been invented for party lines in which each party line appears on the connector switch, one switch being used for each station. In a system patented by Mr. F. Aldendorff, of Antwerp, Belgium, and assigned to the Western Electric Company, the party line appears upon the connector once only, the station selection being effected by an auxiliary ringing selector. The number of the called station must, of course, be related to the character of the selector cur-

rent required. When a selection has proceeded to the required point, a finder associates an idle ringing selector with the connector switch and the impulses next arriving serve to select the proper current supply for the desired station and to connect this station with the connector, so that when the next set of impulses drives the latter to the terminals of the desired line the proper station will be rung. As soon as the ringing is completed the ringing selector and its finder are free. Thus a few sets of these selectors and finders may serve many connectors.

Prepayment System

Mr. W. Aitken, of Liverpool, England, is the inventor of a prepayment system in which a call-registering device is mounted at the substation. This device has a removable part, which may be obtained from the telephone company already set for a certain amount of service according to the price paid. The patron inserts this unit in his register, and service is rendered until the last call previously agreed upon is used, when the line circuit is opened.

Railway-Dispatch Apparatus

A rather elaborate selective-call apparatus forms the subject of a patent granted to Messrs. M. F. Geer and R. C. Leake, of Rochester, N. Y. Buttons are depressed to correspond with the desired stations and a rotating handle is driven forward to effect the selection. The speed of the handle is controlled by a centrifugal brake. Current for selection and ringing is supplied from generators which are driven by a motor which is started when the first selection is made. When the selection is completed all the parts are restored to their normal position and are then ready for re-use. This patent is assigned to the General Railway Signal Company.

Letter to the Editors

The Attitude of Conciliation

To the Editors of the Electrical World:

SIRS:—What is the greatest need of the public utility company of to-day? If this question were sent broadcast throughout the land it is highly probable the returning answer would be: "The confidence of its patrons in particular and the public in general." There are many phases of a utility company's business which require more than ordinary attention and there are many problems to solve, but the ever-present problem is how to eliminate the prevailing prejudice against corporations. The responsible heads of companies have little difficulty in obtaining the services of competent engineers to construct and operate a property. There is not much trouble in obtaining the financial aid necessary to develop a property if it is well located in a thriving center of population, but there is always difficulty for the best-intentioned corporation when it comes to the subject of winning and holding the confidence and good will of a community. Time and again the question is asked: "Why does this condition continue to exist?" The answer to the query points in two directions, external reasons on the one hand and internal causes on the other.

Looking at the external reasons, we find that there is more than one page of earlier corporation history written over with true stories of greed, aggression and a disregard of public rights. Turning from the past, we find that there is more than one latter-day example of corporation short-sightedness, breach of faith and mismanagement. Added to this is the ever-present yellow journal with its love of startling headlines inveighing against the so-called trusts. Then there are the mouthings of the professional agitator and the theories and vagaries of the self-appointed reform politician. Who can deny that the yellow journal, the agitator and the politician have not had some reason for their utterances because of the mistakes, indifference and incivility of the utility companies under their observation?

Turning to the internal causes of public distrust, it is necessary for each company, through its officials, to make a self-examination. Much regrettable history of corporations which has left its mark of prejudice on the public mind is not chargeable to any present-day company, but existing companies are responsible for what goes on within their own organizations. If a public does not exhibit much confidence in all a corporation says and does, perhaps it is not the public that is most to blame.

The regulation of public utilities by state commissions has advanced step by step during recent years, and it is more than likely that in the near future each public utility company in the United States will be subject to the immediate control of some commission responsible to the people. In the main, patrons, consumers, managers, owners and security holders of public utilities have been satisfied with the results thus far achieved. Uniform rates have been established and uniform systems of accounting have been put into effect. Some commissions have very broad powers, and while the distinction between regulation and management is recognized, there is always a possibility that regulation may be extended. If a state commission has power to dictate what rates shall be charged and what shall be the quality of service and the conditions under which it shall be supplied, then why should it not control the personal treatment which shall be given customers by a public utility company, through its employees? Are not civility, courtesy and attention as much a part of good service as the rate charged or the voltage delivered? These questions are asked, but such supervision is not advocated. However, the trend of the times may bring some surprises in this direction. It may not be an improbable development that representatives of a commission will drop into some of the public offices of utility companies just to learn how the company treats its patrons across the counters and over the telephones, and through this agency a few company managers might be enlightened about the way their assistants are handling the public.

Many officials of companies will say: "Oh, things are altogether different now from what they once were—the public is being well treated." For the present it may be acknowledged that there has been a great improvement in matters of this kind. Managers have sent out correctly worded circular letters with carefully prepared instructions to employees as to how the public must be treated. If the instructions given were carried out, conditions would be ideal; but they are not always. Time and again a man may be told to be civil and polite, but he will not be so unless he desires. In other words, real civility and courtesy must come from within a man and not from without.

It too frequently happens among corporation employees that the words "serve" and "service" are not rightly understood. The utility company serves the people, consequently the company and its officers and employees are servants. Dignified service is honorable and in no way degrading unless the servant himself degrades it. Life is made up of service; all are servants in some respects, although perhaps masters in others. The motto of the heir to the throne of England is "I serve." The policeman on his beat, the judge on the bench and the governor in the Capitol all serve, and the President of the United States is the greatest servant of all because he serves all the people.

Now, if a servant in a house should become uncivil, inattentive, indifferent or discourteous to his master, would the master be pleased? Would he love that servant and say that he would help him all he could? No, not likely! The master would say to himself: "I will let that fellow go as soon as I can find someone decent to take his place." The relation between the utility company and the public is very similar. The public is the master and the company is the servant. The company does business by virtue of a franchise granted by the public. The public patronizes the company and from the public the company derives its income. The company is the servant and the public is the master. In the very nature of things the servant must frequently ask the master for favors. Are they granted cheerfully or reluctantly? That depends upon how the servant has pleased the master.

The public is the people, but whom does the public know as the company? Not the bondholders, stockholders or directors, not the president, secretary or manager—just the employees who transact the company's business with the public. In all truth, a company is known and judged by the men it keeps; at any rate, the public knows of no other way to determine whether a company is good, bad or indifferent—no other way to tell whether a company is worthy of confidence or entitled to distrust. If the confidence of the public is the greatest need of the public utility company to-day, then the way to obtain that confidence is to conciliate.

It has now become the habit to dwell upon the word courtesy in referring to the relations between a public utility company and the public, and it is a good habit. But there are degrees of courtesy, or, rather, there is the imitation and the real article. There is the formal courtesy of the lip and manner and there is the courtesy which flows from the heart. The former freezes and the latter warms, and the one is seldom mistaken for the other. Stripped of all verbiage, genuine courtesy is the "doing unto others as you would that others should do unto you." But courtesy is not all that is required to obtain confidence; there must be conciliation. This word expresses a combination of the attributes which compel confidence, namely, consideration, alertness, sympathy, attention and courtesy.

The paramount question is how to spread the gospel of conciliation among company employees so that they may be permeated with the knowledge of what the word stands for and its importance to them and the organizations of which they are a part.

Connected with every modern electric company there is a new-business department, and it is a notable fact that the experienced salesmen attached thereto do not require to have the word "conciliation" explained to them. They have learned that there can be no success in their work without courteous cheerfulness. They know that conciliation makes friends and friends make business for the salesman. Now, if the salesman has learned how to spell "conciliation," what has kept the cashier, order clerk, collector and troubleman so backward in their lessons? Because the cashier or order clerk is behind a counter in an office and the customers go to him to do business, is he any better than the salesman, who must go out and seek the customer? Is there any reason why the office man should adopt an air of superiority and talk to the customer abruptly, impatiently or uncivilly? There is no reason why, but even now in the office of almost every electric company of any size there are some clerks who are putting their company in a bad light by indifference and discourtesy to the company's patrons. It is acknowledged that there are offices where exceptional conditions prevail, but only where this matter has had special attention.

The principal points of contact between a company and the public should be guarded by men who have been carefully selected for the positions they are to fill. The manager will find that for the good of his company and its standing with the public he cannot give too much thought to this important matter. The question of salary should not be allowed to interfere with getting good men for such work, and keeping good men at it. Men of the wrong stamp are dear at any price. Men who are forgetful, moody, grouchy or dyspeptic should be kept in the background, and only such men as are cheerful, alert and considerate should be in the forefront in whatever place or through whatever medium the company does business with the public.

Some men are born with the natural desire to win friends by conciliation, some men may have this quality developed in them by education, and others could never acquire it by any possible way. Most electric companies have regular or occasional meetings of their employees, and it is suggested that at these meetings those responsible for proper public relations should give a series of "little lessons on conciliation." Employees might be called upon to demonstrate how consumers should be handled under different conditions. At each meeting one department should show by actual representation the ideal way of pleasing the public from its standpoint. In their turn those in charge of office work, collection department, selling department, trouble department, service department and telephone exchange should show to others in the company how the work can be done in a manner which will please and make friends. The manager should be on hand to criticise, suggest and point out the value of the right way and the injury resulting from following the wrong way. Such a program will impress employees with the absolute necessity for conciliation and will produce good results where circular letters of instruction would not avail.

There is an attitude of conciliation which almost every man can assume if he is personally desirous of impressing another to gain a wished-for end. It expresses a desire to please which may be clearly seen in the eyes, in the features, in the gestures and in the tone of voice, which cannot be misunderstood. This attitude of conciliation is visible not only in personal contact, but may be traced in the wording of letters and felt in conversations over the telephone. If a man can effectually assume this attitude in personal matters, why can't he assume it when transacting business for the company which pays for his services?

Some men think they have done their full duty toward the policy of conciliation if they "meet the customer half way." Some go a little further and say, "Give the customer the benefit of the doubt," believing that should satisfy and please. But no! Both classes of men have stopped too soon, for in a complaint or controversy the real attitude of conciliation assumes that "the customer is always right." Before such an attitude complaints are forgotten, troubles vanish and opposition fades away. The attitude of conciliation does not imply continuous kowtowing, bowing and scraping. It does not mean a loss of self-respect, or the relinquishing of any rights. On the contrary, the implied consideration for the feelings and rights of others adds dignity to a position, costs nothing, and yet will yield the most marvelous returns.

A corporation, in its defense, will sometimes state that it is only an aggregation of individuals. What is the public but a greater aggregation of individuals? The corporation which consistently and persistently adopts the attitude of conciliation with its patrons will realize some day that, having pleased the individuals, it has won the much-desired confidence of the public.

Los Angeles, Cal. S. M. KENNEDY.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Condenser Lifts Water from the Sump

By drilling a hole in the side of a Leblanc condenser which is operated in connection with a 3000-kw turbine in the station of the Massillon (Ohio) Electric & Gas Company, attaching a 0.75-in. pipe to the opening and extending the pipe to the nearby sump, the condenser has been made to do the work of a sump pump. A valve in the 0.75-in. pipe line adjusted at intervals keeps the water in the sump at about the same level at all times, care being taken not to let the water get below the intake of the suction line so that air will enter the condenser. For emergency service and to aid the suction line in case water enters the sump faster than it can be removed through the 0.75-in. pipe a steam siphon has been installed, which is capable of lifting the water into the canal at the side of the station.

Preventing Waste of Excess Exhaust Steam

BY A. E. ANDERSON

The sight of steam escaping through the atmospheric valve and going to waste is not pleasing to the manager of a combined electric and heating plant. Visions of dollars and cents floating into the air greet his eyes and the waste assumes large proportions. This loss may occur only during the period of the daily electric peak, but it is none the less displeasing and indicates an unnecessary waste.

Such a condition existed during the past heating season in the plant of which the writer had charge. Live steam had to be supplied to the heating system from twenty to twenty-two hours per day, but as this loss nevertheless continued during the daily peaks, a way was sought to correct this condition in order that "no guilty steam might escape."

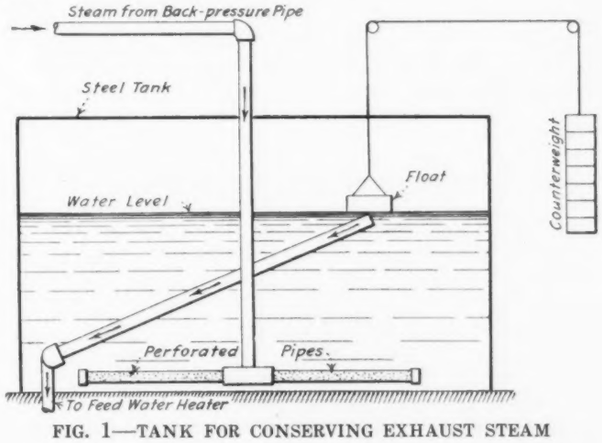


FIG. 1—TANK FOR CONSERVING EXHAUST STEAM

At first it was planned to set an old fire-tube boiler on end and to utilize the excess exhaust by passing it through the tubes to heat the water in the boiler. This was, however, quite out of the question as it would have been necessary to tear out a brick wall to get the boiler in place. There was, moreover, not enough floor room for the installation. Even then the problem would have been only partly solved as some steam would have passed through the tubes and into the air and the heat radiation from the boiler shell would have been large. Covering the boiler would have been quite expensive.

It was therefore decided to utilize the exhaust steam by heating water in a steel tank over the coal bin, this water then passing to the feed-water heater and thence to the boilers. Just below the back-pressure valve a tee was installed and a pipe run to the top of the tank and then down to the bottom where a home-made heater is placed. This heater consists of two capped pipes perforated with small holes and screwed into a tee at the end of the pipe from the back-pressure pipe. In this way not only is all the excess exhaust steam condensed, but the softening effect of this steam is obtained and its effect has been noticed in cleaner boilers.

In the original lay-out the hot water was drawn from the bottom of the tank and then taken to the heater. It was soon found that the cold water in the bottom of the tank was being drawn off, allowing the hot water to dissipate its heat to the tank room. This was afterward changed, a pipe being arranged with a float and counterweight so that the outlet pipe was always at the surface and "skimmed" off the hot water. This arrangement has since worked out very nicely.

During the months of September, October and November the temperature of the water in this tank frequently rose to 140 deg. and 150 deg. During December, January and February, however, the heating load had grown so heavy and the weather was so severe that we did not have enough steam to take more than "the chill off the water."

The maximum pressure carried on the heating main is 3.5 lb., and the back-pressure valve has been set at 5 lb. A bell alarm has been devised so that when the back-pressure valve opens, showing an excess of exhaust steam, this bell rings. The attendant then opens the valve to the tank heater. When the valve has been open and the bell again rings showing that the exhaust supply is just equal to the heating demand, the valve is closed.

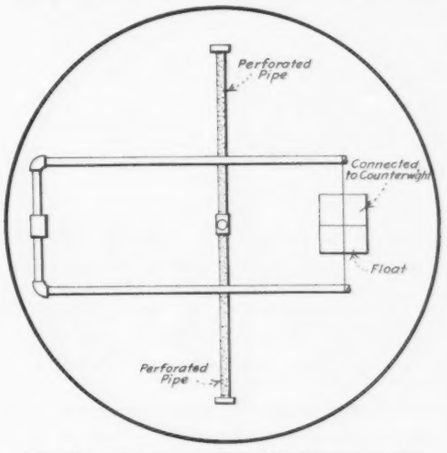


FIG. 2—PLAN OF CONDENSATION TANK

To prevent the tank water from siphoning over into the exhaust main, an automatic air valve was placed in the steam pipe to the tank heater, thus allowing air to enter the pipe and prevent the forming of a siphon.

No boiler troubles due to oil have been experienced. A year ago oil enough to lubricate the feed-pump cylinders was taken from the pit into which the water and oil and grease from the separator in the heating main empties. Since this time the oil consumption has been cut down very materially and no pitting or corrosion is seen in the boilers. The force-feed lubricator on the low-pressure side of the compound engine has been taken off, as the steam from the high-pressure side carries over enough oil for the lubrication of the low-pressure cylinder.

With this simple arrangement the plant has made an appreciable saving in coal—in fact, a number of new heating customers were added before the coal consumption showed any increase over that of the previous season. There has been only one evening in about five months that steam escaped into the air from the plant, and the old familiar sight and sound of puffing steam is now entirely absent.

Control of Large Motor-Driven Machine Tools

Nowhere is the ease and convenience of electric drive better illustrated than in the control and manipulation of very large machine tools like those illustrated herewith. Indeed, it may almost be said that the operation of such machine tools would be impossible without the completeness and delicacy of speed control made feasible through the use of individual motors. Fig. 1, for example, shows a large 10-ft. by 10-ft. by 20-ft. reversing-motor planer, used in the shops of the Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo. The largest of the five motors with which the machine is equipped is a 50-hp reversing motor which runs at speeds of from 250 r.p.m. to 1000 r.p.m. and drives the planer bed. An 8-hp, 1200-r.p.m. motor raises and lowers the rail, two 2-hp, 1500-r.p.m. motors drive rapid-travel mechanism for rail heads and side heads, and a

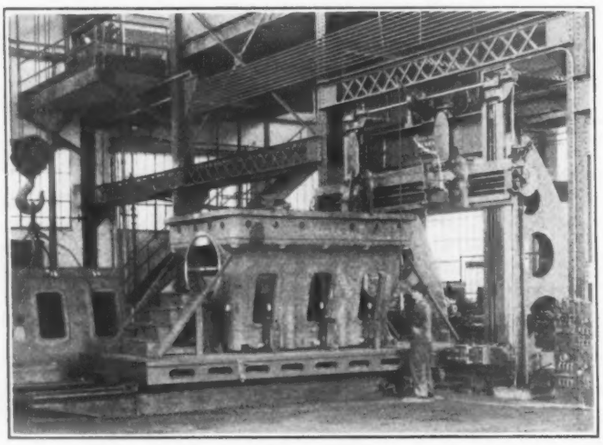


FIG. 1—LARGE REVERSING MOTOR PLANER WITH PENDENT CONTROL

fractional horse-power motor operates an oil pump, providing forced lubrication. In Fig. 1 the planer is shown working on a Diesel-engine frame, the operator in charge having his hand upon a pendent control switch.

Another group of large heavy machine tools in the same shop consists of three large lathes which are capable of turning up stock from 30 in. to 54 in. in diameter and from 8 ft. to 25 ft. in length. The largest machine is driven by a 20-hp motor having a speed variation of from 400 r.p.m. to 800 r.p.m. Rapid travel of the tool carriage is effected through a separate 2.5-hp, 1075-r.p.m. motor. A 12-hp, 775-r.p.m. to 1350-r.p.m. motor operates the medium-sized lathe, and the smaller lathe in the rear is equipped with a 9-hp motor running

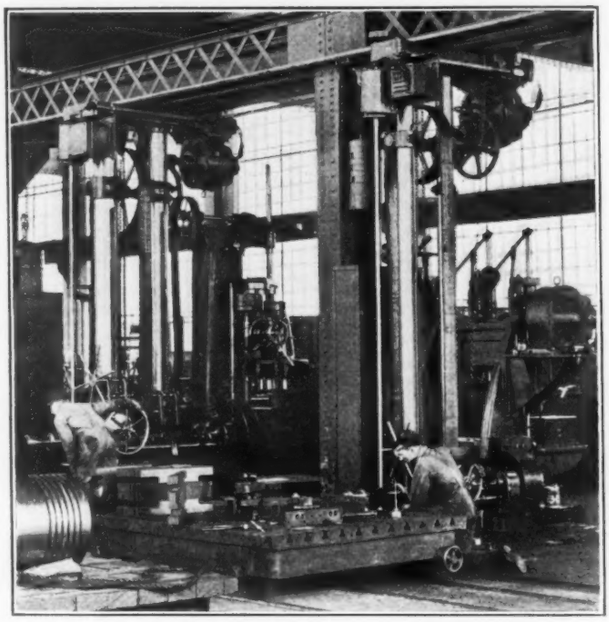


FIG. 2—DRILLS, SHOWING CONTROLLING APPARATUS ON MACHINE COLUMN

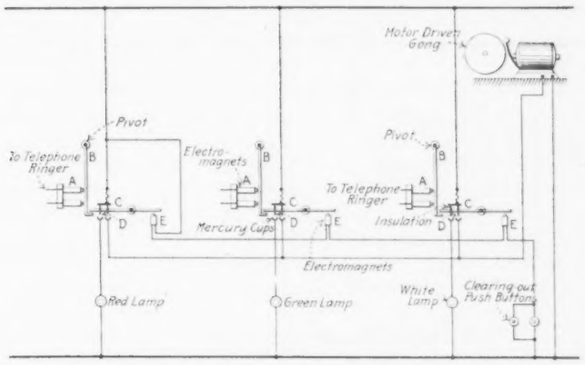
at speeds varying from 500 r.p.m. to 1500 r.p.m. All of these machines are equipped with gear changes providing further speed reductions.

Interesting applications embodying unusual features have been made in connection with two drills shown in Fig. 2. These drills, with a vertical range of 96 in. and spindle travel of 44 in. and 36 in. respectively, are driven by 8.5-hp and 6-hp motors. Starting boxes and rheostats are mounted at the top of the machine columns, control being effected through an extended shaft terminating in a handle always within easy reach of the operator. Work handled by these drills is held on cars with 6-ft. by 8-ft. decks. The rails supporting these cars are accurately leveled and either or both cars may be used with either drill. A revolving table is provided for use with either car.

Telephone Call System with Signal Lamps

Mr. A. L. Platt, engineer of the main generating station of the Canton (Ohio) Electric Company, has recently done away with all separate bell-ringing outfits for the three telephones in the station and has installed an original system, the circuit diagram of which is shown in the accompanying illustration. From the ringers of the three telephones in the plant, the Bell, the Stark and the private lines, conductors are led respectively to the three sets of electromagnets marked *A*. When the ringing current from an incoming call energizes one of these sets of magnets, the lever *B* swings toward the pole-pieces, allowing the pivoted horizontal lever *C* to fall by its own weight and immersing the small contact points *D* in the mercury contained in the cups beneath. This completes the circuit through the colored lamp corresponding to the ringing telephone

and also energizes the motor-driven gong. Both the lamps and the gongs continue in operation until one of the push-buttons shown at the right of the illustration is operated by the person answering the telephone. Sets of these push-buttons, connected in multiple, are situated both in the booth containing the three telephones and in the office of the chief engineer. Actuation of

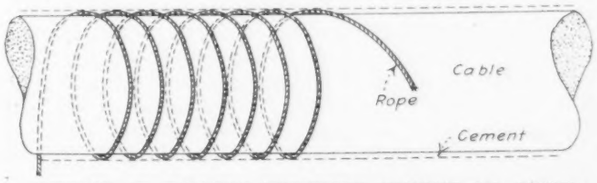


CONNECTIONS FOR HOOD-RINGING TELEPHONE

the push-buttons, as will be seen by tracing the circuit, energizes the electromagnets *E*, returning the pivoted lever *C* to its original position. These magnets are wired in series, no provision having been made for selective operation.

Method of Fireproofing Cables

Various cements, some of them patented compounds with superior heat-resisting qualities, are used to cover cables in manholes and in basements of buildings. In emergencies cables in these places are sometimes called upon to render service when a fire is raging about them, and the covering should be applied so that it will not be



METHOD OF HOLDING FIREPROOF CEMENT ON CABLE

easily cracked or chipped and broken off. A common method of preparing the cable for the coat of cement is to wrap the length of cable to be protected with an ordinary 0.25-in. rope, leaving about 0.75-in. open space between each turn. With the rope fastened at each end the wrapped exterior of the cable presents a surface to which the cement will adhere just as plaster clings to lath in a building.

Methods and Cost of Electric Heating

We have a 400-kw hydroelectric plant available for supplying energy for electric heating. Please advise us concerning the cost of electric heating, watts required per cubic foot of space heated, methods of heating recommended, etc. W. J. E.

Among the methods of electric heating which have been employed satisfactorily are direct radiation from resistance elements, hot-water heating from a single central plant, individual hot-water units, and forced-draft hot-air systems. A system employing hot-water heated in a single electric boiler is advantageous from the maintenance viewpoint because the heating elements do not deteriorate rapidly, being maintained at a low temperature by the surrounding water. Another advantage obtained with this system is that heat can be stored in the water during off-peak periods, consequently lower energy rates can be obtained. As the efficiency of electric heaters is a definite unchanging quantity, the effectiveness of this form of heating can be improved only by preventing radiation from the building to the outer air and by excluding cold air which may seep in through cracks. A forced-draft hot-air system has the advantage of counteracting cold-air seepage, but has the disadvantage of increased maintenance charge due to resistance deterioration. The Ontario Power Company's office building at Niagara Falls is heated exclusively by the latter system. The motor-driven blower and set of heating elements utilized cost $388 and consumes 85 kw. Seventy-two thousand cubic feet of office space exposed on three sides is heated. A central-plant hot-water system, costing about $1,200 installed, has been employed with considerable satisfaction in the Biltmore House, Atlantic City. The water heater consists of a cylindrical tank 5 ft. long and 3 ft. in diameter containing twenty 5-kw heating elements inclosed in concentrically arranged, parallel copper tubes. Water is heated from faucet temperature to 180 deg. Fahr. with an average efficiency of 85 per cent. The heating elements being surrounded with water have shown a normal life considerably in excess of that usually obtained with air-cooled resistance wire. The heater operates on 230 volts with either alternating-current or direct-current energy. An electric steam generator used in the laundry of this house gives from 95 to 100 per cent efficiency. Feed water is taken from the hot-water mains and is delivered at practically zero pressure. The generator consists of a drum containing five 3-in. vertical pipes each surrounded by a 7-kw heating element. Carefully conducted experiments have shown that from 85 watts to 110 watts is equivalent in heating ability to low-pressure steam condensing on 1 sq. ft. of radiating surface with a temperature difference of 126 deg. Fahr. Some engineers estimate that 1.5 watts to 2 watts is sufficient to heat 1 cu. ft. of space under average conditions. When direct radiation from resistance is employed, it is recommended that thin, bare, flat resistance wires be utilized. Fireproof or asbestos-covered wire should be used in preference to rubber-covered wire on all heating circuits. Inclosed fuses on these circuits have been found to deteriorate more rapidly than other forms. Solder should never be used on any part of an electric heater, as it is liable to melt. Switches should preferably be placed directly on the heating unit, otherwise the connections between the unit and the switch should be inclosed in conduit. When a hot-water or steam-heating system is employed particular attention should be paid to the type of switch used as they must not be affected by moisture or steam. Assuming that a certain hot-water-heating system using coal containing 14,000 lb. Fahr. units has an efficiency of 50 per cent, an electric boiler producing an equivalent amount of heat would require 2 kw-hr. of electricity per pound of coal fired in the first case at 100 per cent efficiency. Therefore, to compete with coal at from $10 to $11 per long-ton, electricity must sell at about 0.25 cent per kw-hr., omitting the stand-by losses in a heating system using coal. When heat is supplied during only a small portion of the time, these losses are considerable, so that an economy may still be effected when the energy rate is as high as 2 cents or 3 cents per kw-hr. If a 400-hp boiler is used, electricity at from 3 mills to 5 mills per kw-hr. would be equivalent to coal at $10 per ton in producing heat. Successful competition with coal may become possible if heat can be stored in water during off-peak periods.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Commutation.—K. PICHELMAYER.—A brief illustrated paper on the role which the armature field plays in commutation phenomena.—*Elek. u. Masch.* (Vienna), March 8, 1914.

Variable-Speed Dynamos.—A note on a recent British patent (No. 30,107, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. To maintain constant pressure across a variable-speed dynamo a differential exciting winding is provided, and a resistor of carbon, tungsten or tantalum, containing a material such as boron, having a marked negative temperature-resistance coefficient, is used in series with one winding. There are several modifications.—London *Elec. Eng'ing*, April 2, 1914.

Lamps and Lighting

Mercury-Vapor Lamps.—F. P. KERSCHBAUM.—An illustrated article on the absorption of light in mercury-vapor lamps and an arrangement to avoid it. The author describes a method of reducing the absorption of the ultra-violet rays passing through the vapor in a mercury-vapor lamp. For this purpose water cooling is used to reduce the density of the vapor, and a magnetic field is applied to deflect the arc so that it is near the quartz. The effectiveness of the method is demonstrated by the results obtainable with a mercury resonance lamp when excited by the lamp here described. Such a combination provides a source of monochromatic ultra-violet light such as is not easily obtained by other means.—London *Electrician*, April 3, 1914.

Stage Lighting.—H. H. REEVES.—An illustrated article on the best practice in the construction and installation of the equipment which controls the electricity supply for stage lighting. The usual layout of the stage equipment is pictured, and particular attention is directed to those locations for the electrical equipment which produce the most effectiveness in presenting a performance. Wiring diagrams of the main circuits and of convenient arrangements for wiring the switchboard are given. The suggestion is made that the motion-picture machine shall be connected to the secondary service lines. In the event of the blowing of the main fuses a possible panic may thus be easily averted, for the audience can be entertained with pictures until normal conditions can be restored.—*Gen. Elec. Review*, April, 1914.

Incandescent Lamps.—A note on a recent British patent (No. 17,416, 1913) of Siemens & Halske A. G. Where a chemical compound is used in the bulb for the purpose of giving off gas, this is arranged to be heated by a special wire in series or parallel with the filament; for example, it may be wound round a tube containing the compound. The wire is of such material that its cross-section decreases with time and therefore runs hotter, thus tending to maintain the quantity of gas evolved constant as the amount of the chemical left decreases.—London *Elec. Eng'ing*, March 26, 1914.

Signal Lamps.—G. R. NYLO.—An illustrated description of the arrangement of signal lamps on some Berlin bridges for the regulation of the boat traffic.—*Elek. Zeit.*, April 2, 1914.

Generation, Transmission and Distribution

Current-Limiting Reactors on Large Power Systems. K. M. FAYE-HANSEN AND J. S. PECK.—A paper in abstract read before the (British) Institution of Electrical Engineers. The operation of current-limiting reactors is discussed with a view to indicating where they may be placed and the sizes which should be used in the different positions in order most satisfactorily to accomplish the desired results under various conditions. The advantages of placing reactance in generator leads are: The busbar voltage may be kept constant, giving the same voltage on all feeders; no damage to the generators in the case of a short-circuit on a feeder or a busbar; no damage to the generator circuit-breakers in any case; synchronous apparatus will not fall out of step in the case of a short-circuit on the generator. The disadvantages are: Enormous current rush into a short-circuit on a feeder; excessive load on the feeder circuit-breaker in the case of a fault on a feeder; synchronous apparatus may fall out of step; a complete shut-down may follow a short-circuit on a feeder or "busbar." The advantages of reactance in the feeders are: A short-circuit on a feeder causes no serious disturbance on the system and there is no excessive overload on circuit-breakers or generators; the feeder circuit-breakers may be of smaller breaking capacity than those where feeder reactances are not used; the tendency of synchronous apparatus to feed back in the case of a busbar fault is slightly reduced by the feeder reactors. The disadvantages are: The voltage drop on the feeders will vary with the load and cannot be compensated for by varying the busbar voltage; a short-circuit on the busbar or generators is a short-circuit directly on the terminals of all generators; the generator windings and circuit-breakers may be damaged and the complete plant shut down; a short-circuit on any generator or between any generator and its circuit-breaker may throw an excessive load on this circuit-breaker, and if it fails to clear the fault the whole system will be shut down. The size of the feeder reactors will depend on the capacity of the feeder, as compared with that of the generators, and upon the breaking capacity of the feeder circuit-breaker. The advantages of busbar reactors are: Trouble is confined to the particular section on which the fault occurs; the amount of current that can be fed into a fault is reduced; the danger in the case of bad synchronizing is considerably reduced. The disadvantages are that no protection to a generator is given when a short-circuit occurs on or near its busbar section, and that the generators coupled to the different busbar sections must be operated with a certain angular displacement in their voltages. Reactors between busbar sections may be exceedingly useful for confining any disturbance on the system to that particular section on which the trouble occurs, and thus it is possible to operate a large number of generators or two or more stations in parallel with almost the same factor of safety against a complete shut-down as though they were operated separately. It is seldom, however, that busbar reactors are used except in conjunction with reactors in generators or feeders.—London *Electrician*, March 27, 1914.

Generator Short-Circuit Current Waves.—F. D. NEWBURY.—The author discusses some of the more important characteristics of the theoretical short-circuit current wave, describes two methods of approximating the maximum possible short-circuit current from an oscillograph record, and defines reactance and short-circuit current as applied to short-circuit conditions, as follows: The short-circuit current of a generator is the peak value of the first cycle of current in one phase after a short-circuit is established, when the short-circuit occurs at that point in the voltage wave of the phase in which the current is measured, resulting in maximum short-circuit current. Short-circuit of the complete winding shall be assumed unless other conditions are specified. The transient reactance of a synchronous generator is defined by the relation, reactance $= E/I$, in which E is the maximum value of the voltage at the instant before short-circuit and I the corresponding maximum value of the sine component of the short-circuit current. It follows from these definitions that the ratio of the short-circuit current to the peak value of rated current is approximately equal to 180 divided by the reactance in per cent.—*Elec. Journal*, April, 1914.

Regenerative Motor-Control.—A note on a recent British patent (No. 6806, 1913) of Crompton & Company and H. Burge. A motor is connected in series with a motor-generator across the line. There is a field winding on the motor through which the current is automatically decreased or increased as the motor speed rises or falls. This winding is connected between one side of the line and a choking coil across the armature, or through a slip-ring to the armature.—London *Elec. Eng'ing*, April 2, 1914.

Electric Drive in Workshops.—O. POLLOK.—Machine tools gain considerably in efficiency if driven directly by motors with variable speed. For the present it is hardly to be expected that three-phase commutator motors with variable speed will come near the direct-current commutator motors with respect to low price and possibility of speed regulation. Without the use of direct current with a normal voltage of 220 or 2×220 volts the great advantages of electric driving cannot be utilized in general for machine shops.—*Elek. Zeit.*, April 2, 1914.

Electric Drive for Ship Propeller.—H. PETERS.—After a brief review of the present status of electric driving of ship propellers, the equipment of the *Tynemount* is described. By the use of currents of different frequency the screw, which is driven by a three-phase motor with short-circuited armature, can be operated at different speeds.—*Elek. Zeit.*, April 2, 1914.

Steam-Turbine Condensers.—A. R. SMITH.—The author discusses the three common types of condensers, the surface condenser, the low jet condenser and the barometric condenser. To afford a ready comparison of the different types, he has arranged a table which shows at a glance the advantages and disadvantages of each. The question of the best form of drive for the auxiliaries is discussed, and a recommendation is given for motor drive from an auxiliary non-condensing turbo-generator set. The several types of air pumps, circulating pumps and hot-well pumps are described and the merits of each are pointed out. Numerical data and curves are added.—*Gen. Elec. Review*, April, 1914.

Power in Foundries.—A. E. RICHARDS.—An article giving data on the production problem in the foundry and machine-shop industry. The article shows the economic situation now confronting the foundry and machine-shop industry and how purchased energy affords a means of solving many of their problems.—*Elec. Journal*, April, 1914.

Traction

Railway Signaling.—H. G. BROWN.—An illustrated paper read before the (British) Institution of Electrical Engineers on the signaling of a rapid-transit railway. The author considers in some detail the various methods of signal lay-out where an automatic system is used to control the traffic of a rapid-transit railway. The effects of delays, and especially of the length of the station stop, are also dealt with. Some figures derived from practical experience are given.—London *Electrician*, April 3, 1914.

Installations, Systems and Appliances

German Electrical Industries.—Continuations of the series of reviews of the status of the different branches of electrical engineering in Germany in 1913. Usbeck writes on electric railways, V. Engelhardt on electrometallurgy, K. Arndt on electrochemistry. The series is to be continued.—*Elek. Zeit.*, April 2, 1914.

Wires, Wiring and Conduits

Relays.—F. E. RICKETTS.—An article illustrated by diagrams on the protection of transmission circuits by relays.—*Elec. Journal*, April, 1914.

Electrophysics and Magnetism

Electrification Produced During the Raising of a Cloud of Dust.—A note on a recent (British) Royal Society paper by W. A. D. Rudge in which the author stated that during the raising of a cloud of dust a considerable amount of electrification occurs. Insulated conductors held in a stream of dust become charged to a potential of some hundreds of volts. The dust particles seem to be charged by friction among themselves, some with positive, others with negative electricity. If a cloud is raised by blowing air through a wash bottle containing finely divided material, the air accompanying the cloud becomes strongly charged, and this charge persists in the air for some time. The sign of the charge carried by the air depends on the nature of the material. Mercury sulphide, sand, molybdic acid and "acidic" bodies in general give negative electricity, while coal, flour, red lead, alkaloids and "basic" bodies give positive electricity. A very small amount of dust —10^{-10} grams per cubic centimeter—would give rise to quite strong charges. The finer the material the stronger and more persistent is the charge.—London *Electrician*, March 27, 1914.

Secondary Electronic Radiation.—A. J. PHILPOT.—A note on a (British) Physical Society paper on the asymmetric distribution of the secondary electronic radiation produced by X-radiation. Homogeneous X-radiations, characteristic of various elements, have been employed to eject electrons from gold. By an ionization method the relative energies of the electrons emitted in the direction of propagation of the exciting X-radiation and in the reverse direction have been measured for each of the homogeneous X-radiations employed. It has been found that the ratio of the energy of the former to that of the latter increases with the penetrating power of the exciting radiation, its value rising from 1.11 when the mass absorption coefficient of the X-radiation was 5 to 1.24 when the mass absorption coefficient was 0.5.—London *Electrician*, April 3, 1914.

Photochemical Rays.—H. L. HEUSNER.—A continuation of his article on photochemical rays and their measurement.—*Zeit. f. Feinmechanik*, March 20, 1914.

Electrochemistry and Batteries

Silit Resistors.—G. EGLY.—An illustrated article on the manufacture and uses of resistors of silicon carbide called silit. Silicon carbide, silicon and carbon are mixed together, pressed into forms, and heated at 1500 deg. C. in an atmosphere of carbon monoxide, whereby the silicon is changed to silicon oxycarbide. By further

heating to 1600 deg. or 1700 deg. the carbon reduces the oxycarbide to silicon carbide so that the whole mass consists now of silicon carbide baked together in a very firm manner. Resistors made in this way can be used as electric resistors, as heating resistors and as refractory material.—*Mitteil. Siemens & Halske,* February, 1914.

Units, Measurements and Instruments

Hot-Wire Ammeter.—W. H. Eccles.—For making measurements of the effective current in a certain high-frequency circuit where it was difficult to hold values steady for more than a second or two, the author has devised the following simple quick-reading hot-wire ammeter (Fig. 1). Two fine wires *AB, CD,* of the same gage and material and about 10 cm long, are stretched between electrically independent supports so that they are not in the same plane. Near the place of shortest distances a cross-wire *CW* is soldered parallel to *CD.* The wire *CD,* which does not carry any current, is provided with a torsion head at *C,* and by twisting this the cross-wire can be made to press on the wire *AB.* Thus, when a current is passed through *AB,* the expansion of the wire due to the heating by the current is taken up by the rotation of the cross-wire. A light mirror, indicated by the dotted lines in the figure, is attached to the cross-wire and to the torsion wire, and it is advisable to crank the cross-wire a little so that the mirror does not touch the active wire *AB.* The period of the mirror is determined by its mass, by the torsion modulus of the wire *CD,* and by the elastic resistance of *AB* to lateral displacement. This period can easily be made of the order of a twentieth of a second. With copper wires of No. 40 S. W. G. an instrument can be built to measure currents ranging from 0.02 amp to 0.2 amp. The low resistance and quick action of such an instrument made it very valuable in the carrying out of some researches on resonance curves belonging to certain rather unstable quenched-spark plants.—London *Electrician,* March 27, 1914.

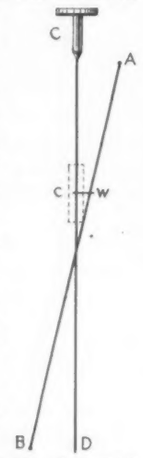


FIG. 1—HOT-WIRE AMMETER

Electrometer.—W. H. Eccles.—In an article on some instruments for high-frequency currents and voltages the author describes an exceedingly simple electrometer, which can be made sensitive enough for the detection of the voltages arising between the condenser plates in the secondary circuits used in wireless telegraphy and can be rigged up in any laboratory as follows: Clamp at its lower end a very fine wire or a silvered glass fiber in a vertical position, and cut away its upper end gradually until it can stand erect. It is convenient to have the clamp which supports the wire supported itself on leveling screws so that the operation of balancing can be carried out with perfect control, and it is necessary that the wire should be protected from air currents by inclosure in a chamber. In the writer's instrument the chamber is about 10 cm high with two brass sides 3 cm apart and with glass back and front 2 cm apart. The chamber has a brass top, and its base is a brass disk provided with leveling screws and carrying the fiber clamp. One of the brass sides is slotted, and an ebonite cover slides over the slot and can be clamped at any height. Through the ebonite an electrode projects horizontally nearly up to the vertical fiber. The ebonite is clamped so that the electrode is level with the top of the fiber. For the particular experiments which the author had in hand at the time, the electrode and the fiber were connected to the same side of the condenser. The movement of the fiber away from the electrode was observed by aid of a horizontal microscope provided with an eyepiece scale. In one such instrument the vertical fiber was a fine phosphor-bronze strip 9 cm long, and potential differences of a hundredth of a volt could be detected when the connections were as indicated above. Other possible modes of connection are obvious.—London *Electrician,* March 27, 1914.

Telegraphy, Telephony and Signals

Tuning of Wireless Telegraphy Receivers.—W. H. Eccles.—In the conclusion of his article on recent patents in wireless telegraphy and telephony a patent of the Compagnie Générale Radiotélégraphique is mentioned for a system of connections facilitating the tuning of a receiving set. The arrangement is shown in Fig. 2. Suppose, first, that the antenna and secondary are right out of tune with the signals to be received, and let the switch *N* be over against the point *O.* The telephone *T* and the detector *L* are in a non-oscillating circuit closely coupled to the antenna at *RD,* and, therefore, by varying either the antenna inductance at *D* or the antenna condenser at *F,* or both, the signals can be picked up. Then, while keeping the switch on *O,* vary the condenser *C* or the inductance *S,* or both, in the secondary circuit *SQCBE,* which is loosely coupled to the antenna at *BE.* As this circuit comes more nearly into tune with the signals, the loudness of the sounds in the telephone will diminish, till when the circuit is perfectly in tune there will be no trace of the signals. One way of explaining this is to observe that the energy picked by the antenna from a train of damped waves is passed in much greater proportion to a circuit in resonance than to one not so adjusted. Thus when the signals have vanished from the circuit including the point *O* the switch may be moved over to *P* and the signals be found in strength in the loosely covered secondary.—London *Electrician,* March 27, 1914.

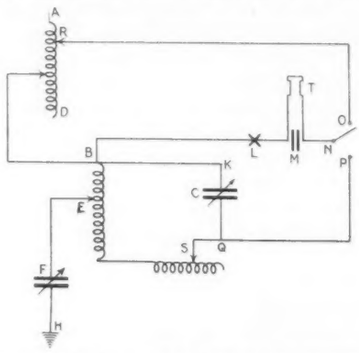
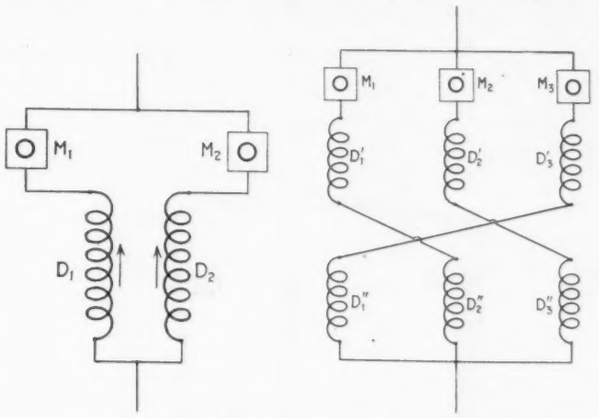


FIG. 2—CONNECTIONS TO FACILITATE TUNING OF RECEIVERS

Working Microphones in Parallel.—W. H. Eccles.—In the concluding portion of his illustrated serial on recent patents in wireless telegraphy and telephony a method of R. Goldschmidt is described which enables microphones to be worked in parallel satisfactorily. As it is impossible to make two microphones which will remain perfectly alike electrically, it has hitherto been necessary to use microphones in series. The present invention overcomes the difficulty for a pair of microphones by putting in series with each microphone a coil so wound that the surging of the compensating currents which always arises through unequal operation of the instruments is prevented by the mutual inductive action of the coils. Fig. 3 shows the arrangement: M_1, M_2 are the microphones, and D_1, D_2 are coils wound oppositely on a common core. Equal currents down the coils cancel each other's magnetic field, but a circulating current would build up a field and therefore experi-

ences a great choking effect. When more than two microphones are to be connected in parallel they may be caused to work uniformly by pairing them and applying the above method. But a more advantageous arrangement is that shown in Fig. 4, where coils D_1' and D_1'' act on each other, and the remaining coils are paired similarly. Still another method is given in the specification. A coil in series with each microphone acts on one and the same secondary current. If the microphones operate unequally, the presence of the secondary tends to choke the circulating current; if they operate equably, the secondary current tends to neutralize the self-inductance of the coils. The method promises to be of importance in radiotelephony. It suggests, by the way, the possibility of making oscillatory arcs work in parallel.—London *Electrician*, March 27, 1914.



FIGS. 3 AND 4—ARRANGEMENT TO PREVENT SURGING OF COMPENSATING CURRENTS

Telephony in Rural Districts.—An illustrated article on the Steidle telephone system in use in Germany. There are a manual main exchange and automatic subexchanges.—London *Electrician*, March 27, 1914.

Book Reviews

ELEMENTS OF ELECTRICAL ENGINEERING. Edited by J. L. LaCour. Vol. I. Theory and Calculation of Electric Currents. By J. L. LaCour and O. S. Bragstad. Translated by Stanley P. Smith. New York: Longmans, Green & Company. 482 pages, 404 illus. Price, $5.

This well-considered book will be of great use to the electrical engineer. Any scholarly treatise is of much value, when compared with the enormous quantity of slipshod and careless contributions to what is termed "technical literature." The book contains much to interest the student of alternating-current phenomena. The chapters on inversion are not only extremely interesting but also fraught with practical results. Other chapters of interest are those on impedances in series and in parallel circuits. The chapter on capacity in circuits is remarkably simply and clearly treated; it is doubly valuable on account of a discussion of distributed capacity. Load diagrams of electric circuits, leading to the circle diagram, are discussed with skill and interest. A chapter on harmonic analysis and one on resonance, with remarks on the wave-shape, are of interest. Load diagrams of polyphase circuits are lucidly presented. The subject of eddy-current losses in conductors, as first presented by Messrs. A. B. and M. B. Field, is given in considerable detail. The book may be heartily recommended.

PRACTICAL USES OF THE WAVE-METER IN WIRELESS TELEGRAPHY. By J. O. Mauborgne. New York: McGraw-Hill Book Company, Inc. 74 pages, 42 illus. Price, $1.

This book is an outgrowth of a pamphlet printed for use at the Army Signal School, Fort Leavenworth, Kan. The author begins with a series of fundamental definitions and relations, and proceeds to describe the basic operation of all wave-meters of the resonance type. The Pierce meter and three types of Telefunken instrument (all of which are used by the United States Signal Corps) are discussed in detail. The later chapters contain specific instructions for and examples of wave-meter measurements of open and closed circuit wave-length, coupling inductance, capacity, decrement, etc. Attention is given to the adjustments necessary to make transmitters comply with the various federal regulations as to wave-length and radiation purity. The measurement of received wave-lengths is described, and a full-page chart which simplifies computation of frequencies and wave-lengths from inductance and capacity, or vice versa, is presented. In future editions a discussion of simpler methods of measuring antenna constants and of the adjustment of "quenching" transmitters would be welcomed. As the book now stands it should be extremely useful to all who have occasion to make resonance measurements at radio frequencies.

PROBLEMS IN ALTERNATING-CURRENT MACHINERY. By Waldo V. Lyon. New York: McGraw-Hill Book Company, Inc. 136 pages. Price, $1.50.

Collections of problems for the use of engineering students are always of somewhat doubtful value to any but the compiler, unless they appear as numerical examples in school textbooks. It is easy to originate problems, but all problems involving the theory of electrical machines are not of equal value in familiarizing the student with the fundamentals of electrical engineering. The problems here presented by Mr. Lyon have the merit of being carefully developed by an instructor whose experience enables him to judge accurately of their educational value. The problems refer to transformers, synchronous generators and motors, induction motors, converters, polyphase circuits, and non-sinusoidal waves. The answers are not given, but will appear as a second volume in the fall of this year. It is admittedly difficult to preface the various groups of problems by introductory material and explanations which shall be of value without occupying too much space, and the author has decided to omit entirely any such introductory paragraphs. He may be justified in his decision; but, on the other hand, there are many problems which must of necessity present difficulties not only to students but also to instructors not thoroughly familiar with the courses of instruction on which these problems presumably are based. The exact predetermination of alternator regulation under various load conditions is generally admitted to be impossible on the usual sine-wave assumptions, which alone justify the use of vectors; but some methods of calculation are easily recognized as being worse than others. Problems in alternator regulation are based on the "synchronous impedance," the "magnetomotive force," and the "general" methods. The reader who does not understand these terms is, of course, unable to solve these particular problems, and it is doubtful whether the publication of the answers will help him to any appreciable extent. The difficulties in the way of producing a book of problems without explanatory matter must not, however, be underestimated, and this collection will in any case prove suggestive to teachers of electrical engineering, even if they cannot use all the problems without first adapting them to their needs.

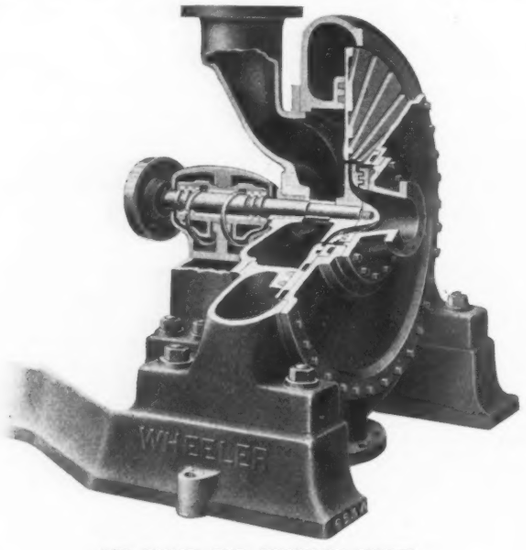
New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Turbo-Air Pump

The turbo-air pump illustrated herewith consists of a high-speed impeller, a ring of diffusion channels and a casing. The impeller discharges water in separate streams into the fixed compression or diffusion ring, and the blades of this ring cut the jets of water into a large number of layers which close the channels and force the entrapped air out against atmospheric pressure. Air is admitted to the center of the casing by a large nozzle on the bearing side of the pump and is drawn into the diffuser around the impeller. Use is made of a small-diameter impeller which rotates at very high speeds, being thus suitable for directly connected turbine drive.

In a test on this pump with the temperature of the water at 70 deg. and the air-suction passage cut out a vacuum 100 per cent of the theoretical was maintained.



AIR PUMP FOR TURBINE DRIVE

With 10 cu. ft. of free air per minute the pump maintained a 29.1-in. vacuum, corresponding to a vacuum of 99.7 per cent of the theoretical. With 18 cu. ft. of free air per minute there was a vacuum of 29 in. This corresponds to a 99 per cent vacuum, which is greater than that of a large surface condenser with normal leakage.

This pump is manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., and is similar in design to the rotary pump made by the Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.

Manhole Guard

A manhole guard with two horizontal steel rings which are supported by five hinged metal uprights is shown herewith. The top ring is provided with an opening for access to the manhole about which it is placed. By means of the hinged arrangement the guard is made collapsible. When in position two loose sleeves on the lower ends of the two front uprights forming the entrance to the guard engage with stubs on the front half of the bottom ring and hold the uprights in place so that the guard will not collapse. Steel and malleable-iron fittings are used in the construction of this guard, which is manufactured by the Universal Cable Grip Company, Syracuse, N. Y.

MANHOLE GUARD WITH HINGED UPRIGHTS

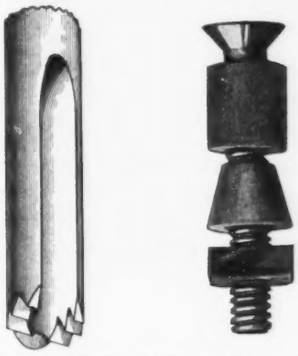
Electric Bench Washing Machine

The electric bench washer shown in the accompanying illustration is equipped with a platform made of angle iron, gas pipe and malleable-iron corners. The side table can be easily removed. The total floor area occupied is 24 in. by 39 in. The tub is attached firmly to the platform and has a bottom outlet. The wringer can be swung to any desired position and a safety release insures against injury to the clothes or the operator's fingers. The lightest and the heaviest articles are handled without changing the tension. This machine is manufactured by the Automatic Electric Washer Company, Newton, Ia.

ELECTRIC BENCH WASHER

Tools for Drilling

A set of tools for drilling holes in stone, concrete and brick which will prove valuable to wiremen has been placed on the market by the Chicago Expansion Bolt Company, 1808 North Forty-second Avenue, Chicago, Ill. An expansion bolt and bridle ring are also being made by this company. The manufacturers claim that



FIGS. 1 AND 2—CUTTING EDGES OF BIT, AND EXPANSION BOLT

with the rapid-cutting bit and the improved accessories labor cost can be materially reduced without impairing the installation. The cutting teeth of the bit are arranged so that each stroke applies a cutting surface at a new point, thus eliminating the centering tendency. Dust is removed from the drill hole through a slot in the shank of the bit. With the expansion bolt force is applied by means of a screwdriver to wedge the steel cone into the lead and spread the lead so as to fill the hole. With the ring a hollow-shanked drill is used.

Electric Letter Sign

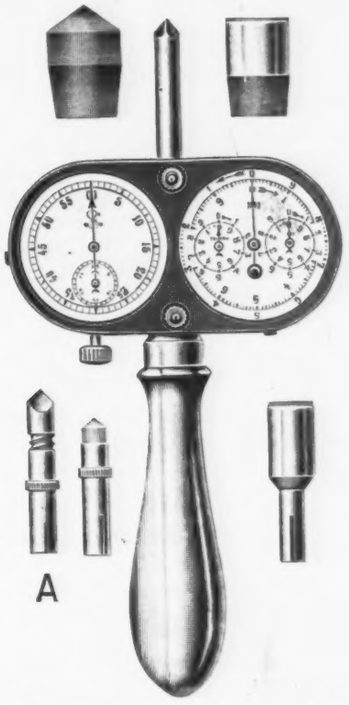
Each unit of the electric letter sign shown herewith is made up of four parts, a porcelain base, a 10-watt lamp, a lantern and a glass letter. The base is equipped with a small brass projection at one end which fits snugly into the adjoining base. The lantern fits securely over the neck of the porcelain base and its finish is a telephone-black on the outside and a blue-white on

LETTER SIGN

the inside. This lantern is open from the front and the back and therefore permits one to insert the glass letter in the front, leaving the back open, or to use the letters in both the front and the back. In the former case it is well adapted for display-window lighting, the white interior of the lantern reflecting the light into the window without affecting the brilliancy of the sign; in the latter case a sign that can be hung in a store and read both ways is the result. The letter is made of black flash opal glass with a high finish. Porcelain spacers are provided for separating the words of the sign. The porcelain bases fit into a metal trough which is furnished in sections. These sections may be joined together to accommodate any length of sign. The width of all letters and space blocks is 2.75 in. This Midas sign, as it is called, is being placed on the market by the Mercantile Advertising Company, Broadway and Herald Square, New York.

Combined Speed Counter and Stop-Watch

The instrument shown in the accompanying illustration consists of a speed counter and a non-magnetic stop-watch. The counter dial is graduated to read speeds up to 10,000 r.p.m., and the instrument may be used, it is claimed, on shafts rotating at speeds as high as 20,000 r.p.m. without injury. Revolutions in either direction



SPEED COUNTER AND STOP-WATCH

are registered, and the direction of rotation is indicated by the appearance of a red or black disk on the dial, the color of which agrees with that of the corresponding dial figures.

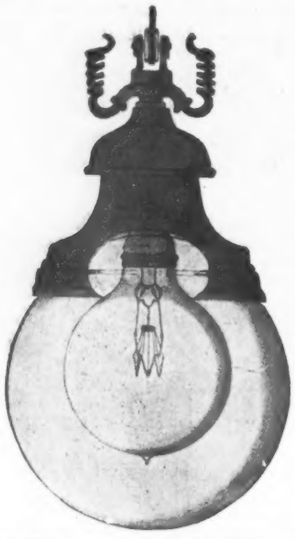
To use the "tachoscope," as it is called, it is merely necessary to press the spindle upon the end of the shaft under test. This operation starts the watch and the counter simultaneously, and they run as long as the instrument is held in position. When the instrument is removed the pointers show the time elapsed and the number of revolutions made until returned to the zero position by small levers provided for the purpose. The instrument is inclosed in a morocco leather carrying case, and the total weight, including that of the case, four tips of different sizes, an extension piece and a bottle of oil, which are assembled in the case with the instrument, is 1.375 lb. Mr. James G. Biddle, 1211 Arch Street, Philadelphia, Pa., is the importer of this device.

Pull-Chain Socket

The pull-chain socket shown in the accompanying illustration is being placed on the market by D. R. Ostrander & Company, 22 Dey Street, New York. The chain is completely insulated from the live parts of the socket. The socket is equipped with a double-make and double-break mechanism which is designed to carry a considerable overload without affecting the contacts. The cap and shell are connected firmly together, as shown in the cut.

Tungsten Lamp with Large Outer Globe

A tungsten lighting fixture with large outer globe for either outdoor or indoor use is being placed on the market by the Post-Glover Electric Company, Cincinnati, Ohio. Solid bronze is used throughout. The fixture is



TUNGSTEN LAMP WITH OUTER GLOBE

equipped with a reflector of baked-porcelain enamel and either a standard screw-base socket or a mogul socket. Either the ordinary tungsten lamp or the nitrogen-filled 750-watt or 1000-watt unit can be used. This fixture, which is known as the "Flam-bo," is made weatherproof. No set screws or other parts which are liable to rust are used.

Electric Glue Heaters

In the heating of glue, when steam is used, only about one-fifth the amount of heat generated is said to be used in the actual heating of the glue. Four-fifths of the heat energy, therefore, radiates through the pipes and creates a heat that in summer tends to reduce the efficiency of the workmen. With gas the same results are obtained, with the added risk of fire. With electricity, using a heat-retaining jacket to conserve the heat, waste energy is reduced to a minimum, and a

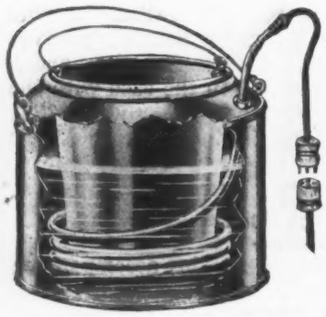


FIG. 1—ELECTRIC GLUE HEATER WITH HEATING COIL

FIG. 2—ELECTRIC GLUE HEATER WITH DISK HEATING ELEMENT

safe, convenient and cheap heating agent is the result.

In the illustrations herewith are shown electric glue heaters made entirely of copper and brass. In Fig. 1 is shown a portable glue heater with a single pot and a single water-jacket and a heat-retaining jacket surrounding the water which is made of a material that is a non-conductor of heat. It is heated by a coil as shown and can be connected to any ordinary lighting socket. The heater shown in Fig. 2 has a disk heating element. It is also provided with a water jacket and a heat-retaining jacket surrounding the water. The heater shown in Fig. 3 is similar in construction to the two

FIG. 3—NON-PORTABLE ELECTRIC GLUE HEATER

heaters described above, but it is not portable. It is made in sizes with capacities varying from 2 gal. to 50 gal. When complete this heater is supplied with a thermometer, a stand and a water gage.

These electric glue heaters are manufactured by the Advance Machinery Company, Toledo, Ohio.

Single-Lamp Standard for High-Efficiency Lighting

A single-lamp standard having a globe of ornamental design is being manufactured by the Holophane Works of the General Electric Company, Cleveland, Ohio. The globe consists of two pieces. The upper part is made of a dense opal glass known as "Pyro," and the lower part

SINGLE-LAMP STANDARD

of an opal glass of light density. The upper portion serves the purpose of a reflector. The unit is designed for use with high-efficiency tungsten lamps of either the multiple or series type. With a 750-watt multiple tungsten lamp the maximum candle-power is said to be 950 at an angle of about 65 deg.

Jobber, Dealer and Contractor

Noteworthy Features of New England's Largest Jobbing House

Two notable features deserve special emphasis in the electrical jobbing house of the Pettingell-Andrews Company, of Boston, Mass.: the specialization of the concern in illuminating engineering and fixture merchandising and the comprehensive display accorded electrical household conveniences in connection with a broad policy of co-operation with contractors and dealers. The establishment is situated in the wholesale district of the city, and the company does not strive to capture a large volume of retail trade in competition with local dealers, its policy being rather to supplement the activities of the latter in the sale of supplies by making itself as useful as possible to the trade as a whole. To accomplish this, an extensive stock of electrical conveniences is carried in the company's storehouse adjoining the main offices and a liberal space is set aside on the ground floor of the latter for the accommodation of visitors, whether these are sent to the house by New England central stations, by contractors and local dealers, or whether they call upon their own initiative.

Fig. 1 illustrates the display facilities of the house as one enters the offices. Visitors are cordially greeted at the information desk shown in Fig. 3 and, in case waiting is necessary, are invited to make themselves at home at a large reading table provided with the latest issues of the principal electrical periodicals. The trade-mark monogram of the house, 6 ft. square and illuminated by five 15-watt tungsten lamps, is shown in Fig. 3, and the general lighting of the appliance exhibition room is by 250-watt tungsten lamps installed in indirect reflectors. Liberal space has been allowed for passage between tables, counters and large apparatus units shown upon the floor. In the foreground are

FIG. 2—ENTRANCE TO FIXTURE STUDIOS

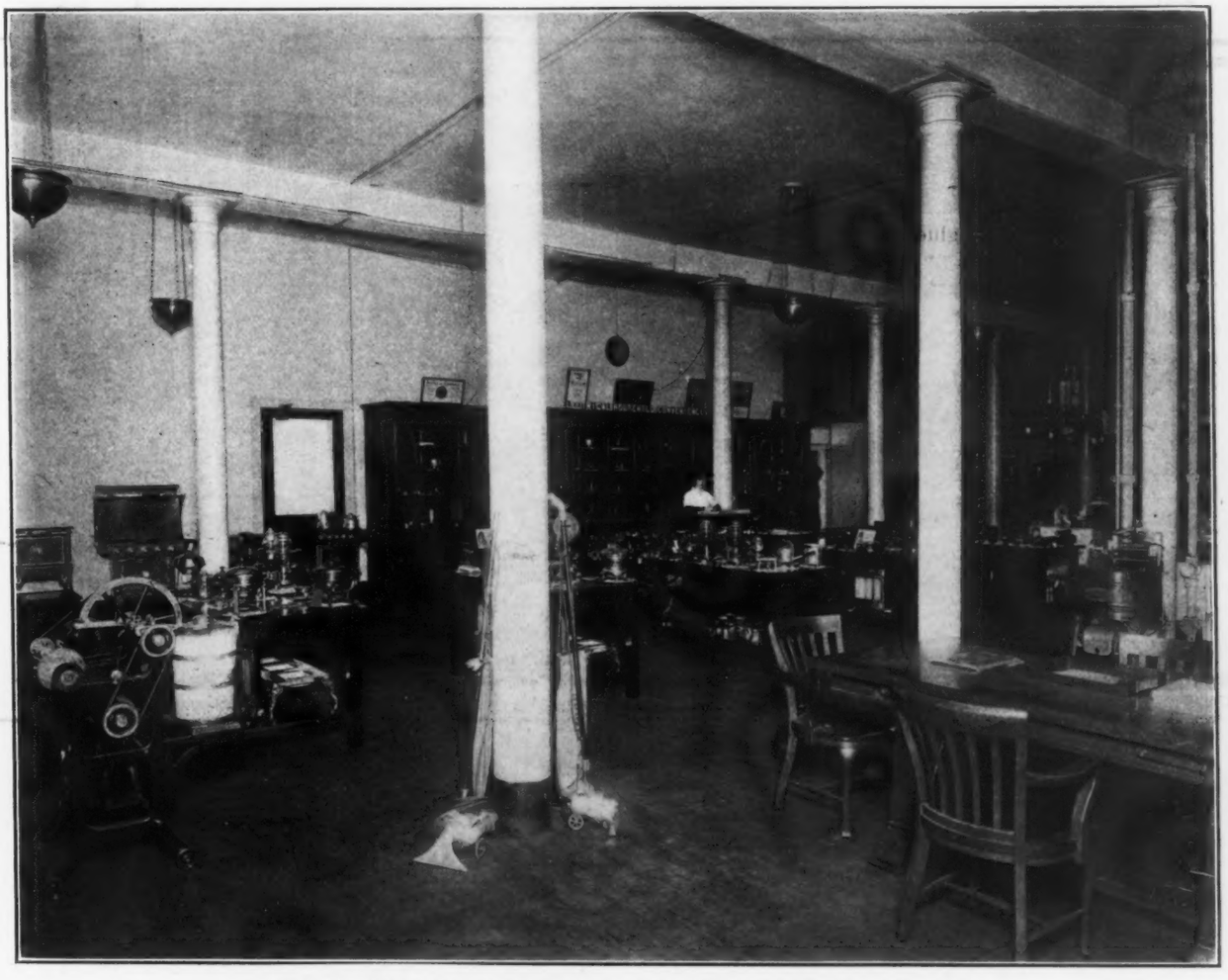


FIG. 1—APPLIANCE DEPARTMENT, PETTINGELL-ANDREWS COMPANY

FIG. 3—ILLUMINATED TRADE-MARK MONOGRAM

FIG. 4—ENGLISH ROOM

shown utility machinery, heating and cooking appliances, washers and other products of interest to the householder, while against the rear wall a striking display is provided in the form of a mahogany cabinet 25 ft. long, 8 ft. high and 30 in. deep, equipped with four plate-glass shelves and surmounted by a sign "Electrical Household Conveniences," formed on Stanley block letters of 15 watts rating each. The house is strongly opposed to merchandising electrical equipment as "energy-consuming devices," preferring to emphasize the convenience of apparatus in the home and elsewhere instead of its expenditure aspects. The main showcase is illuminated by fifteen 40-watt tungsten lamps mounted in a reflector trough at the top of the cabinet. Miscellaneous heating appliances are shown in the cabinet, and in front of it is a plate-glass showcase for smaller devices, such as flash-lamps, battery instruments, medical coils, clock lamps, etc. A counter at

FIGS. 5 TO 8—OAK, FRENCH, COLONIAL AND SILVER ROOMS

GRIPPER AND SIDE GUIDE

FIG. 9—SUPPLY DEPARTMENT SALES COUNTER

FIG. 10—LAMP-SHADE EXHIBIT

the right is equipped with four outlets for testing, each outlet having a red pilot lamp indicating when the circuit is alive.

At the rear of the appliance department space is set apart for the display of switches, motors and heavier equipment. Fig. 10 shows the method of exhibiting industrial lamp shades by attaching them to conduit carried about 10 ft. above the floor in a horizontal rectangle, and a convenient method of exhibiting cross-arms and insulators for transmission lines. A saving in first cost of mounting this equipment was made by attaching the arms to pairs of posts supporting a stairway to the second floor. The usual 5-ft. 6-in. arms are shown spaced 16 in. apart on centers, and forty-seven insulators are shown in a space about 6 ft. square and 5 ft. high. Suspension and pin-type insulators are shown, the former being hung from an iron rod at the side of the inclosure. The sale of supplies is handled at a counter illustrated in Fig. 9, behind which are unit steel stock shelves with sliding ladders providing for easy access to the upper tiers.

The fixture studios, on the second floor, consist of five principal display rooms, offices for the head of the department and an area set apart for the exhibition of mercantile and industrial fixtures, provision for the designing staff being made in adjoining quarters. Fig. 2 is a view of the main stairway leading to the studios, several tapestries and an alabaster fixture inclosing four 25-watt tungsten lamps adding much to the attractiveness of the furnishings. The display rooms are en suite, and are decorated artistically according to a carefully prepared plan. There are a colonial room, 25 ft. long; a silver or blue room, 16 ft. long; an English room, 30 ft. long, all three being 19½ ft. wide; an oak room, 30 ft. long, and a French room, 20 ft. long, both being 16 ft. wide. All the rooms are 11½ ft. high. They are wired for a total of about 900 outlets in walls, ceilings and baseboards, the various circuits being controlled by gang push switches mounted in wall-plates about 4 ft. above the floor.

In general, each room is wired with rows of ceiling outlets containing seven outlets per row, as shown in Fig. 6, the French room, and Fig. 7, the colonial room. Every fixture displayed is controlled either from a push switch in the wall or by a flexible cord and plug. Each wall panel is provided with an individual fixture, and the tables, shelves and other furniture are arranged for the most effective display of portable lamps and standards in great variety. All the rooms are inside chambers, no daylight being admitted, and each may be cut off from its neighbors by heavy portières harmonizing with the color scheme. Portable plush-covered 18-in. by 30-in. panels are also provided with individual fixtures in each for various displays. The French room contains twenty-four wall switches, the English room thirty-five, the oak room thirty-eight, the silver room thirty-five, and the colonial room thirty-three. Effects can be obtained singly and in any desired combination, and the treatment of each lighting installation as an independent problem has been an important factor in the growth of the business. The company does not engage in electrical contracting, but hangs fixtures with its own force when necessary. Its advice has proved its value to both contractors and customers.

House-Wiring Campaign at Cambridge, Mass.

An energetic house-wiring campaign was started by the Cambridge (Mass.) Electric Light Company on March 9, to run until July 1. By arrangement with local contractors the company offers to provide the householder occupying six rooms and a basement with ten lamps, fixtures and shades, wired complete, with tungsten lamps, at a price of $47.50. In a return post card sent to householders the company illustrates the types of fixtures included in its offer and provides space for a notification that a call from a lighting expert is desired at no expense to the signer.

CRIPPEN AND SIDE GUIDE

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Cleveland Utility Using Terry Turbines for Operating Boiler-Feed Pumps.—The Terry Turbine Company, of Hartford, Conn., has recently received an order for two turbines for driving boiler-feed pumps in the Lake Shore station of the Cleveland Electric Illuminating Company, and when these are installed there will be fourteen of this manufacturer's turbines in service in the station mentioned.

Illinois Manufacturers' South American Excursion a Success.—Edwin N. Hurley, leader of the excursion to South American states conducted by the Illinois Manufacturers' Association and president of the Hurley Machine Company, has returned to Chicago. He reports that his delegation received a hospitable welcome and that the tour was a successful one. Mr. Hurley thinks that the interchange of visits between public men and business men in the United States and the South American countries is mutually beneficial.

Extent of the Illuminated Signboard Industry.—According to the daily newspapers, the Chicago manager for the Thomas Cusack Company testified in a recent lawsuit that his company maintained 1500 billboards in Chicago. Of this number it is said that between 400 and 500 are illuminated at night. This statement gives an idea of the extent to which illuminated billboards are used in general and local advertising. The testimony was introduced in a case brought by the Cusack company against the city in an effort to have the city enjoined from enforcing an ordinance requiring billboard companies to procure frontage permits before erecting signs.

Electric Ranges Given Same Freight Classification as Gas Ranges.—By the action of the Western Classification Committee electric ranges for cooking are now given the freight classification of third-class in less than carload lots and fifth-class in carload lots where the minimum carload is 20,000 lb. Where the minimum carload is 24,000 lb. a better rate is obtained. This action places the electric range and the gas range in the same classification. The Canadian roads have made the same rate. George A. Hughes, of Chicago, president of the Hughes Electric Heating Company, has been active in the effort which resulted in the railroads taking this action. He appeared before the Western Classification Committee and showed that the electric range is now in competition with the gas range and should have the same freight rate.

Molded Insulation Applied to Commutator Construction.—The General Bakelite Company, maker of the insulating material of that name, has given out particulars concerning a new application of its product. About two years ago experimental work began with the object in view of improving on the old mica V-ring style of commutator assembling, which was expensive, complicated and liable to disarrangement during operation. After much work on the subject a new method for securing the commutator bars was evolved by which they are molded into the insulating material, which is reinforced by metal rings also embedded in it. This method has reached its most extended use within the last two months, a number of prominent manufacturing companies applying it to the construction of small and medium-sized commutators with gratifying results.

Generating Stations Installing New Apparatus.—Among the electrical-energy-supply projects in this country which are at present engaged in making extensions is the Sierras Construction Company, Riverside, Cal., which is planning the installation at its Imperial Valley (Cal.) plant of a 2000-kva synchronous condenser, three 1250-kva and nine 300-kva transformers, with switchboard and accessories. The Montana Power Company, Butte, Mont., will shortly install a 3750-kva alternating-current generator in one of its stations. The Pittsford Power Company, Rutland, Vt., has purchased recently a 1250-kva alternating-current generator, three 400-kva water-cooled transformers, and a switchboard. An order has been placed by the Florida Power Company, of Ocala, Fla., for two 200-kva transformers, and the Towaliga Falls Power Company, of Griffin, Ga., will add to its equipment a 1600-kva alternator and switchboard. All of this apparatus has been, or is being, supplied by the General Electric Company.

Large Boiler Order from Philadelphia.—The Babcock & Wilcox Company has recently secured an order from the Philadelphia Electric Company for 20,180 hp of boilers, with superheaters, and this, together with other large orders recently received, makes an aggregate of 46,300 hp of boiler equipment to be supplied by the above manufacturer. This company is finding present conditions in its line very good. There is a good volume of small orders, which in its case is welcomed in place of the same volume of larger orders. Also, as indicated above, there have been some orders of good size received, and the outlook for future business is excellent.

Wire Company Sees Poor Business Conditions Ahead in the Northeast.—The American Electrical Works have pending orders for thousands of dollars' worth of their various wire products, but because of the present dullness these orders cannot be satisfactorily closed. A representative of that company, recently returned from a trip through Eastern and New England territory, stated that the business sentiment in New York State, New England and Canada is very pessimistic. He said that everywhere he found signs of retrenchment and that improvements and extensions that have been planned and are needed have been held up for a more favorable time. Questioned as to his company's operations during the active portion of last year, he said that, while it had experienced a large volume of business at that time, the margin of profit was small, so that the actual prosperity was less than the surface conditions might have indicated. The recent immense foreign shipments of copper were stated by him to represent the efforts of the producers to keep prices in this country from complete demoralization and he said that to his own knowledge copper has recently been used to some extent as ballast for ships, constituting thus a hidden stock.

Steel Mills Buying Electrical Equipment.—A partial index to activity in the steel business at the present time is afforded by the following record of electrical equipment orders recently placed by several of the large steel companies with the General Electric Company. The Pennsylvania Steel Company, Philadelphia, Pa., will shortly add to the equipment of its mills at Steelton, Pa., a 450-kva regulating set, a 600-hp induction motor and a switchboard. The Detroit (Mich.) Seamless Steel Tube Company is planning to install two new 300-hp induction motors, with control equipment and switchboard. Orders have recently been placed by the Indiana Steel Company, Chicago, Ill., for twenty-seven 15-hp motors. From the Worcester (Mass.) Pressed Steel Company orders have been received for three 300-kva transformers and a 500-hp induction motor, with auxiliary equipment. Work is now progressing on a 4000-kva, two-unit, three-bearing motor-generator set with combined exciter and blower set for the American Iron & Steel Manufacturing Company, Lebanon, Pa. The John Wood Manufacturing Company, Conshohocken, Pa., has placed orders for two 200-kw rotary converters, four 110-kva transformers and a switchboard. The above manufacturer has also received an order from the Jeanesville Iron Works Company, Hazelton, Pa., for three 200-hp induction motors with compensator.

New Line of Small Induction Motors Coming Out.—The Richmond Electric Works, of Richmond, Va., are planning the introduction within a short time of a new line of small induction motors of from ¼ hp to 7½ hp rating, for which they think there is a demand in the market they serve. This company is also arranging at present for the opening of its own office in Philadelphia.

Large Electric Garage Opened in New York City.—Announcement is made of the opening of the Exide Battery Depots, Inc., on Twenty-third Street near Tenth Avenue, New York City. This garage, exclusively for electric vehicles, is modern and complete in every respect. With room for 100 commercial electric cars, it is claimed that it is one of the largest public garages in the country. The United Electric Light & Power Company, which supplies the electricity used in this service station, has been instrumental in introducing a great number of cars and is waging an energetic campaign in bringing the attention of New York's merchants to the economies effected by the modern electric vehicle.

New Electric Heater Developed.—The Electrical Steam Radiator Company, of 130-132 Commercial Street, Portland, Maine, has developed a new form of heating unit, consisting of a steam radiator the steam for which is generated electrically. The apparatus is portable and is made in three sizes, the smallest being about 1 ft. high by about 2 ft. long and the largest being the same length and about twice as high. The small unit will draw 350 watts and the two larger ones will take 500 watts. The apparatus weighs from 18 lb. to 25 lb. and can be operated from an ordinary lighting socket. The control is automatic, being regulated to open and close the circuit between desired limits, and the only care needed is to fill the water tank about once in three months. The officers of the above company are J. D. Ross, president; C. T. Swett, treasurer and general manager, and A. M. Robbins, assistant general manager. Mr. Ross is the inventor of the device, and Mr. Robbins, who will have charge of the sales arrangements, has been connected with various electrical enterprises in and around Boston, Mass., for the past ten years. The main office and factory of the company is at the above address, and a branch office has been established at 437 Oliver Building, Boston, Mass. Arrangements are under way for establishing branches in New York City, Buffalo, Chicago, St. Louis, St. Paul and Minneapolis.

Winter Rains and the Cost of Energy.—The year 1913 was not in all respects an easy one for the hydroelectric companies in the Pacific States, but it may be remembered that statements which were given out by officials of some of those companies during the latter part of last year forecast a better condition for 1914. It is gratifying to note that the truth of these predictions is being confirmed by experience. There are various reasons for the decreased operating expenses which one or two of the hydroelectric companies are now having to meet, and while there is no doubt that one of the most substantial of these is attributable to a cause quite beyond the control of the offices of those companies, its effect on efficient operation is none the less plainly marked. The California rains of last winter —the first of any consequence for three years—have put the pondage at the headworks upon a thoroughly adequate basis, and for many months to come no fears for insufficient water need be entertained. This natural factor has an appreciable effect on the fuel consumption of the auxiliary steam stations, and, in conjunction with other considerations, will continue to exert a favorable influence on the 1914 expense sheet. For the first two months of the present year the Pacific Gas & Electric Company of California reports an increase in gross of $240,574, a decrease in operating expenses of $67,137, and an increase in net of $307,711 (24.8 per cent gain over the corresponding period of 1913).

General Electric Company Developing New Type of Railway Motor for Use in Pittsburgh.—In connection with the equipment of a number of low-floor cars by the Pittsburgh Railways Company orders have been placed with the General Electric Company for the design and construction of 100 sets (of four motors each) of a new type of railway motor. This motor, to be known as the GE-274, is to be of the box-frame, commutating-pole type, with a nominal rating of 30 hp on 500 volts. The two most striking features of the new cars will be their small weight and the small diameter of their wheels, which items are 18 tons and 24 in. respectively. The cars will carry the same number of passengers as those now in operation and will operate on schedule speeds of from 9½ to 10 miles per hour, with about nine stops per mile estimated. The motor design is characterized also by a marked reduction in weight and an improved system of ventilation. The field coils of these motors are to be asbestos-insulated and impregnated, giving them a solid structure, practically indestructible and moisture-proof. They are to be supported on spring metal seats and to be securely held from movement in any direction by spring flanges, resulting in evenly distributed pressure, and preventing abrasion of the insulation. The armature shaft is removable without disturbing the commutator connections or windings. The armature itself is banded while hot. The control system to be used is the Sprague General Electric type M, arranged to operate on the Jones system, designed by P. N. Jones, general manager of the Pittsburgh Railways Company. By this system a permanent series connection is used between the four motors in a unit equipment, and by a combination of series and multiple steps acceleration is completed with practically all of the resistance cut out, thus saving rheostat losses.

How Some Electrical Manufacturing Companies View the Parcel Post.—The parcel post service, now in operation about fifteen months, was early seized upon by electrical manufacturers and supply dealers as a cheap and quick method for shipping small lots or single pieces of apparatus within the weight limit. In connection with this service there has been some criticism recently to the effect that the liability to breakage of goods when sent by parcel post is greater than when handled by express. Several concerns recently visited by an *Electrical World* representative have expressed opinions on this phase of the matter, and these opinions vary somewhat. W. H. Bliven, of Harvey Hubbell, Inc., maker of lighting specialties and wiring devices, stated that his company has shipped a good deal by parcel post and found it cheaper than the equivalent express service, but part of the difference, he thought, was made up by a larger amount of breakage when the former method is used. R. V. Sutliffe, New York representative of the Hoyt Electrical Instrument Works, said that that concern has adopted the parcel post for all shipments, unless otherwise specified, and that with careful packing little or no difficulty has been experienced from breakage in transit. The Electric Controller & Manufacturing Company has found the parcel-post service advantageous in the shipping of replacement parts. According to R. G. Widdows, the New York sales manager of that company, no trouble has been found from breakage in this connection, which is explained in part perhaps by the substantial character of the parts shipped.

Exhibiting the Electric Truck.—The value of a well-selected exhibition of electric trucks as an aid to the sale of such equipment appears to have been overlooked at the recent commercial motor-vehicle show in Boston, where only two manufacturers of battery-operated business cars displayed their wares. A contrast was afforded by the gasoline-truck exhibits, these machines being shown by the score to thousands of interested visitors, not a few of whom noticed the absence of a proper display of electric trucks and perhaps drew the wholly false conclusion that in some way the latter are falling behind the times. The two electric-truck dealers who exhibited were more than repaid for doing so, and an increased volume of sales is directly attributable to the interest aroused at this show, which was perhaps the only comprehensive display of commercial motor vehicles that has been made in the country this year. It is understood that a good many electric-truck dealers and manufacturers were not in favor of a show at Boston or anywhere else this year, and that this was the reason why such a nominal exhibition was made. There is no question that frequent shows are burdensome and tedious and that they cost a good deal of money both directly and indirectly; but, on the other hand, the interest of the business world in motor vehicles is growing to a degree which is steadily driving the horse off city streets, and it is certainly a step backward not to take advantage of every reasonable opportunity to convince the public of the effi-

ciency of this modern method of transportation. It is not the province of the central station to bear the cost of such exhibits, although there is a field for broad co-operation in the supply of energy and garaging facilities at moderate prices. Certainly, the electric truck has come to stay, and there should be a general recognition of the fact among manufacturers that whenever competitive equipments run by gasoline are displayed on a large scale the electric vehicle should have its rightful place under the same roof, where its good points can be dwelt upon and its limitations cheerfully admitted as the stream of inquiring visitors flows by. It may be good policy to forego giving a show for a year or so—this depends upon local conditions—but once a show is decided on, let the electric truck have its opportunity to claim popular attention. It is all well enough to contend that the best exhibit is a working truck on the highway; but the fact remains that there is no place like a well-organized show in which to develop popular interest in one's product through direct, personal methods and close contact with the actual equipment under conditions favorable for searching examination of its design and construction.

What Some Electrical Manufacturers Think About the Proposition of Increased Freight Rates.—In answer to an inquiry concerning the advisability of allowing the railroads of the country an increase in freight rates, the following opinions have recently been received from several large manufacturers of electrical apparatus and material. The Bristol Company, of Waterbury, Conn., maker of electrical instruments, has found its rail shipments to be handled promptly and in other ways satisfactorily, but does not know whether or not an increase in rates is desirable. J. C. Belden, president of the Belden Manufacturing Company ,of Chicago, Ill., maker of insulated wire and other electrical materials, states that the transportation conditions have been found satisfactory by that concern, except that the railroads will evade all just claims until forced to settle. He says that when the railroads generally buy their goods on a basis of free and open competition he will have more sympathy for their demands for higher freight rates. G. A. True, president of the Northern Engineering Works, of Detroit, Mich., makers of electric traveling cranes, states that his company has found transportation conditions good, that its railroad shipments have been satisfactorily handled, and that in his opinion the roads are entitled to the increased rates. Edmund J. Burke, president of the Blake Signal & Manufacturing Company, of Boston, Mass., says that the railroads' ruling that their minimum charge is their first-class rate per 100 lb. is excessive and unreasonably discriminatory against small shipments. He thinks that the present freight rates are ample for the service rendered. A Southern manufacturer of motors states that the transportation conditions in his vicinity are very satisfactory, with the exception of the express service. His rail shipments are usually handled in a satisfactory manner.

NEW YORK METAL MARKET PRICES

Copper	Apl. 14 Bid	Apl. 14 Asked	Apl. 21 Bid	Apl. 21 Asked
Standard spot*	13.50	14.20	13.40	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	64 5 0		64 6 3	
Prime Lake	14.62½	to 14.87½	14.50	to 14.75
Electrolytic	14.30	to 14.40	14.20	to 14.30
Casting	14.10	to 14.20	14.05	to 14.15
Copper wire base	15.75	to 15.87½	15.50	to 15.75
Lead		3.80		3.80
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter		7.00		7.00
Spelter, spot	5.25½	....	5.15	to 5.25
Tin, spot	36.45	to 36.75	35.45	to 35.65
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	17.87½	to 18.12½

***OLD METALS**

Heavy copper and wire	13.62½	13.25
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.80
Zinc, scrap	4.25	4.15

***COPPER EXPORTS**

Total tons to Apl. 21 22,173

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

February Returns of Central Stations.—Central-station returns for February, 1914, have been received by the *Electrical World* from companies generating altogether about one-half of the entire output of the country. For these properties the gross earnings increased from $13,403,175 in February, 1913, to $14,713,000 in February, 1914—a gain of 9.7 per cent for the year. Returns from cities of different size in the State of Massachusetts show a marked uniformity and indicate that the rate of annual increase established by the census reports of 1907 and 1912 is being well maintained. In that five-year period gross income grew from $10,750,000 in 1907 to a little over $16,000,000 in 1912—an increase of just about 10 per cent per annum. February, 1914, reports from the ten largest companies in Massachusetts show an increase in gross from $1,040,834 in February, 1913, to $1,144,903 in February, 1914—a gain of just over 10 per cent for the year. This figure may be regarded as typical for the whole of the Bay State, as the returns relate to at least 80 per cent of all the energy generated in Massachusetts. The energy output of all these companies was a little less than 28,000,000 kw-hr. for the month—an increase of 11.8 per cent over 1913, which shows that, considering strictly energy output of stations (making no allowance for distribution losses, etc.), the gross yield per kilowatt-hour works out at 4.125 cents—practically identical with the value derived from the 1912 census figures. Taking the Massachusetts figures as an index for the whole of the New England States, the central-station companies in that area seemingly acquire new business steadily at about 10 per cent per year. This figure is probably appreciably lower than the rate for the Middle Atlantic States and the East North Central States. These two groups include New York, New Jersey, Pennsylvania, Ohio, Illinois, Indiana, Michigan and Wisconsin and in this manufacturing belt the percentage rate of increase for the year is at least 14 per cent. In New York State alone the companies supplying energy to the large cities (constituting probably 60 per cent of all the energy generated in the State) show an increase of from $2,986,091 in February, 1913, to $3,465,725 in February, 1914—or 17 per cent. A scrutiny of the returns from two of the Southern States, Texas and Florida, shows an expansion coefficient of 12 per cent for the former and 16.5 for the latter. In the State of Texas only 24 per cent of the entire population is urban, and of the urban dwellers over one-half live in the cities of Dallas, Fort Worth, Houston, Galveston, San Antonio, Waco, El Paso and Beaumont. The companies supplying energy to those eight cities generate nearly 80 per cent of all the energy produced in the State. From the returns received from every one of these companies, it is found that the gross income increased from $690,091 in February, 1913, to $773,877 in February, 1914, an increase of 12 per cent. For Florida returns from the four largest cities show that the gross earnings grew from $146,168 in February, 1913, to $170,532 in February, 1914, an increase of 16.5 per cent. This result is typical for the State, since the companies reporting generate at least 80 per cent of all the energy produced in Florida. Another group of states from which returns have been sufficiently numerous to admit of safe generalization are those on the Pacific seaboard. Of all the energy produced in California, Oregon and Washington, over three-fourths is generated by the large Pacific companies having their headquarters in the metropolitan area of Los Angeles, San Francisco, Portland, Seattle, Spokane and Tacoma. Returns from these companies show an increase from $3,167,358 in February, 1913, to $3,370,404 in February, 1914, or 6.5 per cent. It may be somewhat surprising to find the Western cities reporting a smaller rate of increase than those in New England, but the above figures are founded upon official data and are offered without reservations of any kind. They are probably a true reflection of the somewhat unsatisfactory condition of general business which has been recently experienced by the cities on the coast. From the above results it is shown that the gross earnings of all the energy supply companies in the country increased from $30,500,000 in February, 1913, to $33,500,000 in February, 1914. To finance this expansion $1,000,000 is required each month.

Capital of Cities Service Company Increased.—At a stockholders' meeting of the Cities Service Company in Dover, Del., on April 7, an increase in the capital stock of that company from $50,000,000 to $65,000,000 was authorized. The board of directors was re-elected without change, except that Paul R. Jones was elected to fill the vacancy caused by the death of William T. Hoffman.

Bangor Railway & Electric Initial Dividend Declared.—The Bangor Railway & Electric Company directors have declared an initial dividend of one-half of 1 per cent on the $2,000,000 common stock of the company, payable May 1. The Bar Harbor & Union River Power Company, one of the subsidiaries of the above company, is planning the extension of its high-tension distribution line from Ellsworth to Blue Hill, Maine, which line will be completed in the fall of this year.

Operations of Subsidiary of Indiana Traction Company.—In the report of the Union Traction Company of Indiana, Arthur W. Brady, the president, says that during the year the subsidiary Traction Light & Power Company continued to extend its operations. It took from the Union Traction Company of Indiana the contract which that company had for furnishing current at Pendleton, Middletown and Summitville, so that now all light and power business is handled by the one company. At the close of 1913 the Traction Light & Power Company was doing business at twenty places. At all except three of these points the Traction Light & Power Company furnishes light and power directly. At the three places excepted current is sold to the municipality or local company, which makes distribution. The company's operations are profitable and should be extended. During the year the Traction Light & Power Company authorized an issue of $100,000 of 6 per cent fifteen-year first mortgage bonds. The $68,000 outstanding bonds and $49,500 of the capital stock were issued to the Union Traction Company for advances and are held in the treasury of that company.

Montana Power Securities.—Securities of the Montana Power Company, as follows, have been listed on the New York Stock Exchange: The $10,000,000 outstanding of the authorized issue of $75,000,000 first and refunding mortgage bonds; the $9,700,000 outstanding of the authorized issue of $25,000,000 of 7 per cent cumulative preferred stock, and the outstanding $27,057,600 of the authorized issue of $75,000,000 common stock. The mortgage securing the bonds now covers either directly or through collateral trust twelve hydroelectric power plants and four reserve steam plants having about 102,080 developed electrical hp, of which 8080 is steam, 1403 miles of transmission lines, complete distribution systems serving the greater part of Montana, and, in addition, undeveloped water-powers capable of generating about 280,000 hp, of which it is expected that 167,000 hp will have been developed by 1918 through construction of three new plants now under way or definitely projected, so that by 1918 the mortgage will cover plants having about 269,000 developed electrical hp. The mortgage will, immediately after July 1, 1914, be a first lien on about 33 per cent in capacity of the present developed power plants, 20 per cent of the present transmission lines and 31 per cent of the undeveloped water-powers of the system, and upon completion of the new power plants now under construction will be a first lien on a much larger percentage of the total power plants and transmission lines of the system. Although $27,057,600 of the outstanding common stock is entitled to share in dividends, $22,500,000 of the remaining authorized amount is deposited under a voting trust but is not entitled to share in dividends except as follows: $17,500,000 is not to begin bearing dividends until after the complete installation of a new dam and hydroelectric plant near Great Falls, with a capacity of at least 30,000 hp, and is then only to share in dividends as follows: When the Chicago, Milwaukee & St. Paul Railway Company has taken power for six months under the contract with the Great Falls Power Company or whenever the gross earnings of the Great Falls Power Company shall for any fiscal year have amounted to $1,750,000, then $2,500,000 of this stock is to become entitled to share thereafter in dividends and the balance is to become entitled to share in dividends in instalments of $3,000,000 at intervals of one, two, three, four and five years thereafter. The balance of $5,000,000 of the $22,500,000 common stock is not to begin bearing dividends until after the complete installation of the new dam and hydroelectric plant at Thompson Falls, which it is estimated will have a capacity of 30,000 hp, and is then only to share in dividends as follows: When the Chicago, Milwaukee & St. Paul Railway has taken power for six months under the contract with the Thompson Falls Power Company, $2,500,000 shall become entitled to share thereafter in dividends and the remaining $2,500,000 shall become so entitled after another year. Of the common stock on which the dividends are deferred 175,000 shares are deposited with John D. Ryan, Charles H. Sabin and Gates W. McGarrah as voting trustees under a voting trust agreement dated May 5, 1913, and 50,000 shares are deposited with John D. Ryan, F. W. Allen and C. R. McCabe as voting trustees under a trust agreement of the same date.

Columbia Gas & Electric Company Earnings and Business.—The consolidated income account of the Union Gas & Electric Company, of Cincinnati, Ohio, and the Columbia Gas & Electric Company of Huntington, W. Va., shows gross earnings in the calendar year 1913 of $5,497,960. This is an increase of $342,514, or 6.6 per cent, over the previous year. Operating expenses and taxes amounted to $2,574,644, an increase of $50,169 over 1912. Net earnings aggregated $2,923,316 in 1913, as compared with $2,630,970 in 1912. Other income was $471,583 last year, as against $513,953 in the preceding year. Total gross income in 1913 was $3,394,899, as compared with $3,144,923 in 1912. Deductions from income in 1913 aggregated $2,585,955, as compared with $2,631,314. The net income was $808,944 last year and $513,609 in the preceding year. Fixed charges of the Columbia Gas & Electric Company amounted to $589,823 in 1913, as compared with $515,435 in 1912. The surplus in 1913 was $219,121. This compared with a deficit of $1,826 in 1912. Sinking-fund payments of the Columbia Gas & Electric Company in 1913 amounted to $95,005, as compared with $81,096 in 1912. A. B. Leach, the president, says in the report that the general operating condition of the subsidiary Union Gas & Electric Company has been satisfactory. The cost of the betterments and extensions made during the year has been charged to the Cincinnati Gas & Electric Company, and in July, 1913, 5113 shares of stock were received from that company in payment on account of betterments and extensions. The Union company now owns 11,913 shares of the Cincinnati Gas & Electric Company stock. The installation of the new street-lighting system, together with the necessary substation work incident thereto, was completed during the year, and Mr. Leach remarked that it has given general satisfaction. Three miles of underground lines and 135 miles of overhead lines were built to provide for extension of business; 1381 services and 1262 meters were installed. On Dec. 31, 1913, there were 20,326 electric customers, an increase over 1912 of 1286, or 6.75 per cent. The electric new-business department has been reorganized and provided with an adequate force of solicitors. The distributing system has been maintained at a high point of efficiency and good service and has been operated without interruption. The Plum Street generating station has been thoroughly overhauled, and to a large extent the machinery has been reconstructed. This has resulted in a general improvement in efficiency and reduced cost of operation and has provided approximately 9000 hp of increased capacity. It is estimated that during 1914 it will be necessary to spend approximately $103,000 in the electric department for line extensions, services, meters, transformers, etc., required for new business and for other miscellaneous construction work. A new station will be built on the Ohio River at a cost of $7,500,000. The Kentucky properties added 520 new electric customers, an increase of 9.4 per cent. These properties added 42 miles of electric lines to provide for new business. Mr. Leach says that, in view of the two severe floods that occurred and the depressed industrial conditions that existed during the greater part of the year in the territory served, resulting in both increased operating expenses and decreased gross revenue, the directors feel that the results are most encouraging. In conclusion he says that with the resumption of normal business conditions throughout the country a continued and permanent improvement in the earnings of the company is assured.

Business Notes

Norton & Bird, consulting engineers, of Chicago, have moved their office to 111 West Monroe Street, that city.

The R. Thomas & Sons Company has moved its New York office to the new Adams Express Building, at 61 Broadway.

The Southern California Edison Company is planning to move its Monrovia office, in charge of Mr. Fred Schwartz, into larger quarters on or about May 14.

The Asbestos Protected Metal Company, of Beaver Falls, Pa., announces the removal of its Pittsburgh office to 1611 Bennedum-Trees Building, with H. E. Marks continuing as district manager. This company now manufactures a complete line of prepared roofing and shingles.

The Federal Sign System (Electric) has remodeled the four-story building at the corner of Pine and Twelfth Streets, St. Louis, and has made it a headquarters for its electric specialty business in that city. The New York office of the company has been moved to the United States Rubber Building, 1790 Broadway.

The Titan Storage Battery Company is the name under which the business formerly carried on by the Baltimore Storage Battery Company will henceforth be conducted. The new company has secured quarters at Chapel Street and Lister Avenue, Newark, N. J., and manufacturing operations are now in progress at that location.

Hickey & Schneider, New York, manufacturers of electrical specialties, have recently submitted their new designs of open-air-break 44,000-volt and 110,000-volt switches to a series of tests at Atlanta, Ga. These tests, which extended over a period of three months, were conducted by Messrs. John Schneider and M. P. Maxwell, of the company, who are now engaged in preparing a full report relating thereto. The office of the concern has been removed to the Adams Express Building, New York City.

New Industrial Companies

The Moran Electric Company, of Detroit, Mich., has been organized with a capital stock of $2,500 by Samuel J. Moran, J. Moran and Charles E. Long.

The American Wireless Equipment Company, of Boston, Mass., has been incorporated with a capital stock of $50,000 by F. L. Hall, of Stoneham, and L. W. Bishop, of Boston, Mass.

The Bradley Electric Garage Company, of Dayton, Ohio, has been organized with a capital stock of $10,000 by Francis Bradley, Frank Blessing, Albert Miller and T. M. Hiester.

The Gardiner Storage Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $12,000 to manufacture electrical goods. The incorporators are Monroe Mitchell, Joseph L. Toohey and Martin O'Shaughnessy.

The Niagara Searchlight Company, of Niagara Falls, N. Y., has been incorporated with a capital stock of $100,000 by J. F. Murphy, J. Tugby and F. G. Anderson, of Niagara Falls. The company proposes to manufacture lamps, electrical apparatus and supplies.

The National Piano Company has been granted a charter under the laws of the State of Delaware with a capital stock of $50,600. The company proposes to deal in pianos, piano players, electric pianos, etc. The incorporators are W. M. Pyle, G. C. Steigler and L. W. E. McCarthy.

The Provident Motor Supply Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $75,000. The company proposes to manufacture motor vehicles and supplies for same. The incorporators are H. E. Latter, W. J. Maloney and N. P. Coffin.

The Maryland Electric Vehicle & Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture vehicles of all kinds and to deal in electrical goods. The incorporators are J. M. Satterfield, W. P. Carrow and M. M. Hirons, of Dover, Del.

Trade Publications

Valves.—In a folder published by the Nelson Valve Company, Chestnut Hill, Philadelphia, Pa., is described and illustrated the process of manufacture of Nelson steel valves. The care in making and the rigid testing are referred to.

Recording Synchroscope.—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, Ill., in Bulletin No. 3 describe their recording synchroscope. An illustration is shown of a typical wiring diagram for this device and of a perfect synchronizing record.

Automobile Supplies.—The latest catalog of A. J. Picard & Company, 1720 Broadway, New York, contains ninety-two pages of illustrations and brief descriptions of automobile supplies. It will be found useful by automobile owners and manufacturers.

Household Devices.—"A Few Suggestions for the Home" is the title of an attractive booklet issued by the General Electric Company. It refers to electrically heated devices, such as radiators, toasters, percolators and other labor-saving appliances. The booklet contains some excellent illustrations.

Lamps.—An illustrated booklet of twenty-eight pages issued by the Eastern Electric Lamp Company, Hartford, Conn., gives price schedules for various types of lamps, effective April 1, 1914. Three pages of definitions of terms used in the incandescent lamp industry form a useful addition to the catalog.

Cutouts.—An eight-page leaflet issued by the Trumbull Electric Manufacturing Company, Plainville, Conn., contains brief descriptions and prices of its combination switches, panel cutouts, snap-switch panel cutouts, plug cutouts, combination switches in iron boxes and other Trumbull specialties.

Safety Set Screws.—Bulletin 801 of the Bristol Company, Waterbury, Conn., refers to "Bristo" safety set screws. This type of screw protects itself from all danger of the metal spreading and the screw becoming cracked or split. The dovetailed design of screw and wrench contracts the metal under pressure.

Automatic Rectifier.—The Electric Products Company, Cleveland, Ohio, has issued a pamphlet with the title "My Electric Car Simplified," which tells of the simple method of charging an electric car at home with a Wotton automatic rectifier. Its simplicity and ease of operation and its economy are briefly set forth.

Heating Appliances.—The national advertising campaign of the Hotpoint Electric Heating Company, Ontario, Cal., is described in some literature that has been prepared for circulation among dealers. The latest publication announces "Hotpoint Week" (May 11-16) and outlines special inducements to dealers to further the sales of Hotpoint appliances.

Wires and Cables.—Bulletin No. 400-I, of the Standard Underground Cable Company, Pittsburgh, Pa., refers to weatherproof insulated wires and cables. Illustrations are shown of the solid and stranded and double and triple braid varieties, and tables of wire and shipping data are included. Bulletin No. 200-I gives specifications for Standard colonial copper-clad wire.

Isolated Power Plants.—The Main Electric Manufacturing Company, 219 South Beatty Street, Pittsburgh, Pa., has issued an eight-page pamphlet describing the Main electric lighting and power plants. An excellent illustration is shown of a complete plant that occupies a space of 2½ ft. by 8 ft. The generators, switchboards and engines used in these plants are fully described. A price list is given of complete isolated plants of various types.

Insulating Compound Specification.—The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, Mass., has published a reprint of the report made upon a 30 per cent compound by the joint rubber insulation committee of the American Institute of Electrical Engineers under the title "Specification and Analytical Procedure for 30 per Cent Hevea Rubber Insulating Compound." It is divided into two parts: (1) a procedure for chemical analysis and the interpretation of the results obtained, and (2) a specification and chemical limits for a 30 per cent compound.

Personal Mention

Mr. Fred Spears has resigned as city electrician of Springfield, Ill., to go into business for himself.

Mr. A. P. Singer, formerly engineer at the Spy Run power station of the Fort Wayne & Northern Indiana Traction Company, has resigned to accept a position with the Tennessee Power Company.

Mr. E. I. Sifton has been appointed general manager of the Hamilton (Ont.) Hydro-Electric System. He was formerly engineer in charge of the construction of the system. He is to have 5 per cent of his time to devote to private work.

Mr. Bernard E. Sunny, president of the Chicago Telephone Company and other telephone companies and a director of the General Electric Company and other companies, has been elected president of the Commercial Club of Chicago.

Mr. Thomas A. Edison and his family have returned to their home in Llewellyn Park, West Orange, N. J., after having spent six months at the inventor's winter home at Fort Meyer, Fla. Mr. Edison is reported well and several pounds heavier than when he started on his vacation.

Capt. William H. Rose, Corps of Engineers, U. S. A., has been appointed electrical engineer of the electrical division of the department of operation and maintenance of the Panama Canal. Mr. Edward Schildhauer continues as electrical and mechanical engineer of the division of erection.

Mr. W. J. Maxwell, formerly one of the chief operating engineers of the Merchants' Heat & Light Company, Indianapolis, has accepted a position as engineer of the Spy Run power station of the Fort Wayne & Northern Indiana Traction Company, beginning his duties at that plant April 20.

Mr. John J. Treacy, who was recently appointed by Governor Fielder as a member of the Board of Public Utility Commissioners of New Jersey, was sworn in by Secretary of State Carter on April 14. Mr. Treacy succeeds Mr. Winthrop M. Daniels, who was recently appointed by President Wilson as a member of the Interstate Commerce Commission.

Mr. Elbert Hubbard, sometimes known as "Fra Elbertus," was entertained at supper in Dayton, Ohio, on April 11, by the Dayton Jovian League. Mr. Hubbard had given a public lecture earlier in the evening, and Mayor George Shroyer, who accompanied him, was a fellow-guest of the Jovians. Mr. Hubbard is himself a Jovian. About sixty men were present, and speeches were made by Messrs. Thomas F. Kelly and F. M. Tait as well as by the guest of honor.

Mr. C. C. Chappelle has resigned as vice-president and general manager of the Federal Light & Traction Company, New York, effective May 1, to devote his entire time to private business matters. Mr. Chappelle came to the Federal company early in 1911 from the Westinghouse Machine Company, with which organization he held the position of Western sales manager, with headquarters at Chicago. He remains as one of the three members of the executive committee of the Kansas City, Clay County & St. Joseph Railway Company, which is not affiliated with the Federal interests.

Mr. R. H. Sperling, general manager of the British Columbia Electric Railway Company, Vancouver, B. C., has received the offer of a seat on the London board of his company, an offer which carries with it the appointment of Mr. Sperling to an important position as assistant to the chairman of the board, Mr. R. M. Horne Payne. It is understood that Mr. Sperling will accept the new post and that on his return from England, where he has gone to confer with the directors, the name of the company's new general manager will be announced. Mr. Sperling joined the service of the British Columbia Electric Railway Company in 1896 and in the following year was appointed the electrical expert in charge. He later became general superintendent of the company, and on the appointment in 1905 of the then general manager, Mr. J. Buntzen, to a seat on the London board, Mr. Sperling was chosen as his successor.

Mr. D. A. Hegarty, formerly manager of the railway and lighting departments of the New Orleans (La.) Railway & Light Company, has been transferred to the position of assistant to the president and general manager of the Houston Lighting & Power Company, Houston, Tex. Mr. Hegarty was until 1911 vice-president and general manager of the Little Rock (Ark.) Railway & Electric Company, a position which he held three years. He was born in Philadelphia and was educated at the University of Pennsylvania. After early experience in the engineering department of the Pennsylvania Railroad, Mr. Hegarty was appointed engineer in charge of the Richmond (Va.) Electric Railway, which was the first commercially successful electric road in America. Afterward he became general manager of the company, and was later appointed chief engineer of the Norfolk (Va.) Railway. This position he shortly relinquished in order to become superintendent of the Railways Company General, a holding and operating concern. In 1908 Mr. Hegarty joined the staff of Ford, Bacon & Davis, in general charge of the Little Rock property. At last year's convention of the American Electric Railway Transportation and Traffic Association, held at Atlantic City in October, Mr. Hegarty was elected president for 1914.

D. A. HEGARTY

Mr. Milan V. Ayres, recently appointed senior electrical engineer for the Eastern District, Division of Valuation, Interstate Commerce Commission, with office in Washington, D. C., was born at Hamlin, Kan., on Feb. 14, 1875. Mr. Ayres was graduated from the electric department of the Massachusetts Institute of Technology in 1898. After graduation he entered the service of the General Electric Company at Schenectady, N. Y., being employed in the testing department and later in the design of alternating-current machinery. In 1903 he became electrical and mechanical engineer for the Boston & Worcester Street Railway, South Framingham, Mass., continuing in this position until July, 1911. From July, 1911, to November, 1911, he was assistant to the general manager of the Rockland Light & Power Company, Nyack, N. Y. In November, 1911, he became chief engineer of the Mobile (Ala.) Light & Railroad Company, but resigned from that company in 1912 to accept a position with Ford, Bacon & Davis, consulting engineers, New York City, in which position he continued until his recent appointment with the Interstate Commerce Commission. While employed with the Boston & Worcester Street Railway Mr. Ayres was admitted to the Massachusetts bar. Mr. Ayres is a member of the American Institute of Electrical Engineers, the American Electrical Railway Association and the American Statistical Association. He was for several years a member of the publication committee of the New England Street Railway Club, and in 1911 he became a member of the executive committee of the New England Railroad Club. In 1910-1911 he was chairman of the equipment committee of the American Electrical Railway Engineering Association and a member of the executive committee of the Boston Section of the American Institute of Electrical Engineers.

Obituary

Mr. Alfred Noble, a widely known civil engineer and prominent from his connection with the St. Mary's River improvements, the construction of the Pennsylvania Railroad tunnels in New York City, and the Panama Canal advisory board, died at New York, April 19, following an operation for organic trouble. Mr. Noble had received the John Fritz medal for his work on the Pennsylvania tunnels, and he was a past-president of the American Society of Civil Engineers.

Construction

New England

ROCKLAND, MAINE.—The property of the Rockland, Thomaston & Camden St. Ry. Co., which furnishes electrical service and operates the street-railway system in the Camden district, has been purchased by a syndicate headed by Hugh J. Chisholm, of Portland. N. J. Neal, of Boston, Mass., has been appointed managing engineer of the system.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 2 for furnishing and installing a three-motor, 20-hp electric traveling crane at the navy yard, Boston, Mass., to cost approximately $5,000. Plans and specifications can be obtained upon application to the above bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

FARLEY, MASS.—The real estate of the Farley Paper Co., with other real estate in the neighborhood, has been transferred to the Franklin Pwr. Co., a voluntary trust, the trustees consisting of Chauncey D. Parker, Bowen Tufts, Paul D. Webber, M. Bernard Webber and Edward Mason. The papers filed indicate that the company contemplates developing power from Millers River at Farley.

SOUTH HADLEY FALLS, MASS.—The town of South Hadley Falls has assumed control of the electric plant of the South Hadley Falls El. Lt. Co.

PROVIDENCE, R. I.—The city is contemplating the installation of an electrically driven pump at the Pettaconsett pumping station. Electricity for operating the pump will be purchased from the Narragansett Ltg. Co.

THOMPSONVILLE, CONN.—The Northern Connecticut Lt. & Pwr. Co., of Thompsonville, expects to erect within the next six months a new substation. Walter P. Schwabe is general manager.

Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until April 27 for reconstruction of electric-lighting system, steam and exhaust piping at the Binghamton State Hospital, Binghamton. Drawings and specifications may be consulted and blank forms of proposal obtained at the hospital and at the office of Lewis F. Pilcher, state architect, Capitol, Albany, where complete sets of plans and specifications may be obtained. J. H. B. Hanify is secretary of state hospital commission.

DEPOSIT, N. Y.—The Deposit El. Co. expects to rebuild its plant (recently destroyed by fire) at Stilesville and will have complete service restored by May 1. The power station was completely destroyed on April 2 and power service was resumed the same day through temporary installation from a small local plant. The step-up transformer, which supplied Hancock, 11 miles distant, was destroyed. Complete service was renewed April 7 by means of a generator shipped and installed in a local manufacturing concern. John D. Mickle is treasurer and general manager.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until April 27 for new elevators and wiring thereto, at the Kings Park State Hospital, Kings Park. Drawings and specifications may be consulted and blank forms of proposal obtained at the Kings Park State Hospital, Kings Park, the office of the State Hospital Commission, 1 Madison Avenue, New York, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

MINEOLA, N. Y.—Bids will be received by George M. Goodale, clerk of Board of Supervisors, Mineola, until May 5 for the erection of additions to the Nassau County Court House, in accordance with plans and specifications prepared by W. B. Tubby, architect, 81 Fulton Street, New York, as follows: (1) For general contract work, excluding plumbing, heating and electric wiring; (2) plumbing work complete; (3) heating and ventilating; (4) electric wiring.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school building, Department of Education, Park Avenue and Fifty-ninth Street, New York, until April 27 for installing electric equipment in new Public School 51 on Trinity and Jackson Avenues and East 158th Street, borough of the Bronx.

OLEAN, N. Y.—The Olean El. Lt. & Pwr. Co., of Olean, and the Cattaraugus County Ltg. Co., of Franklinville, have filed a petition with the Public Service Commission asking for permission to consolidate under the name of the latter. The petition also asks for authority to issue $250,000 in capital stock and to execute a mortgage for $2,000,000; also to issue $117,000 in bonds. The company contemplates the erection of a transmission line from Olean to Franklinville.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & El. Co., of Poughkeepsie, has closed a contract with the J. G. White Co. Engineering Corpn., 43 Exchange Place, New York, N. Y., for the erection of a duplicate transmission line between Poughkeepsie and Newburgh, to cost about $60,000. It is understood that new generators will be installed in the steam generating plant.

ROCHESTER, N. Y.—The Common Council has adopted an ordinance which provides for the installation of inverted magnetite-arc lamps erected on ornament posts the entire length of Lake Avenue, to cost about $5,292. Ordinances were also passed for the installation of incandescent lamps and concrete poles on Second Street.

ROCHESTER, N. Y.—A syndicate of New York capitalists, represented by Richard B. Hayden, is contemplating utilizing the water from the barge canal and the construction of a power canal from the proposed harbor at Western Wide Waters to the point where it is proposed to erect the power plant. It is estimated that about 20,000 hp can be developed a a cost of about $2,000,000.

SPENCERPORT, N. Y.—Bids will be received by the town of Spencerport until May 5 for $16,000 electric light bonds. For details see proposal columns.

UTICA, N. Y.—The contract for construction of city electric subways on Broadway and other streets has been awarded to William F. Cogley, at $21,770.

WEST POINT, N. Y.—Bids will be received until May 15, addressed to the Quartermaster, West Point, N. Y., for supplying the United States Military Academy with electrical goods, building materials, gas and steam fittings, hardware and other miscellaneous stores specified in schedules to be had upon application to the above office.

BENTON, PA.—Extensive improvements will be made to the plant of the Benton El. Co. and the Benton Wtr. Co., which are controlled by John S. Stone, of Coudersport. Orders have been placed for three alternating-current generators, and an auxiliary plant will be installed in the pumping station at West Creek, which will be driven by a 40-hp oil engine. A turbine wheel will be installed at the water plant and the retaining walls and dam at reservoir will be remodeled.

ELLWOOD CITY, PA.—The Public Service Commission has ruled that the Harmony Co. will not be permitted to carry out its contract to light Ellwood City. This ruling was made because the Pennsylvania Pwr. Co. has already invested $350,000 in a plant and equipment and should be able to furnish the city with adequate service.

KUTZTOWN, PA.—The electric light committee has submitted a report to the Town Council which estimates that it would require an expenditure of $26,000 to make the contemplated additions and improvements to the municipal electric-light plant.

PHILADELPHIA, PA.—The contract for installing the underground distributing system for the Philadelphia Navy Yard has been awarded to the Newport Contracting and Engineering Co., of Newport News, Va., at $12,288.

BAYONNE, N. J.—The New York & New Jersey Construction Co., which has the contract for the Passaic Valley sewer, has acquired property on the Boulevard and Sixty-first Street, on which it will erect a power and air compressor plant, to be used in connection with this work.

HADDON HEIGHTS, N. J.—Bids will be received by the Borough Council for furnishing electricity for street-lighting in Haddon Heights for a period of one year. William J. Dallas is Mayor.

JERSEY CITY, N. J.—Steps have been taken by the City Centre Merchants & Property Owners' Association for the installation of a new electric-lighting system along the business section of Upper Newark Avenue. Michael Sexton is president.

PATERSON, N. J.—Bids will be received by the Board of Public Works until May 5 for furnishing and maintaining electric-arc lamps for lighting the public streets of the city of Paterson. Specifications may be obtained at the office of the Board of Public Works, City Hall. T. Simpson Standeven is clerk.

POMPTON LAKES, N. J.—Bids will be received by the Mayor and Council of Pompton Lakes until May 5 for the construction of an electric-light plant and water-works system, in accordance with plans and specifications which are on file in the office of J. Frank Cornelius, clerk, and at the office of Joseph B. Rider, consulting engineer, 29 Broadway, N. Y. Plans may be obtained from the engineer upon payment of $5.

VINELAND, N. J.—Appropriations amounting to $297,800 have been granted by the State Legislature for the State Home for Feeble-Minded Women at Vineland. The sum of $154,800 was appropriated for new buildings, which include a new building for patients, a new dining hall and dietetic department, including cold storage, to cost $50,000, a new boiler house to replace the temporary one, enlarging the present power plant, at a cost of $33,000, and a new dairy barn, at $13,000. Dr. M. A. Hallowell is superintendent.

BALTIMORE, MD.—Plans are being prepared for the erection of a concrete pumping station (one story) on the north side of the Patapsco River for the Consol. Gas, El. Lt. & Pwr. Co., of Baltimore.

MOUNT AIRY, MD.—The bill authorizing the town of Mount Airy to establish a municipal electric-light plant has been passed by the State Legislature.

WILLIAMSPORT, MD.—The bill authorizing the town of Williamsport to install a municipal electric-light plant has been passed by the State Legislature.

GRAFTON, W. VA.—Arrangements have been completed to consolidate the Grafton Gas & El. Lt. Co. and the Grafton Trac. Co., under the name of the Grafton Lt. & Pwr. Co. John T. McGraw is president of the Grafton Trac. Co.

WHEELING, W. VA.—Bids will be received at the United States Engineer Office, Wheeling, until May 13 for building a fireproof power house and furnishing and installing machinery at each of the dams Nos. 15 and 20, Ohio River. For further information address Major J. P. Jervey.

ALEXANDRIA, VA.—Plans have been prepared by the Alexandria County Ltg. Co. for rebuilding its power house at the foot of Wolfe Street, which will practically double the output of the plant. New machinery, including a 1000-kw turbine, will be installed.

HARRISONBURG, VA.—J. M. Snell, chairman of electric light committee, is getting estimates of cost of the installation of an auxiliary plant at the municipal hydroelectric plant on the Shenandoah River, 12 miles east of Harrisonburg.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent, District government, Washington, D. C., until April 30 for furnishing electrical supplies for the Business High School. Bids will also be received until April 28 for furnishing five ammeters, model 45, and six galvanometers. For further information address the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 28, for supplies to be delivered at the various navy yards and naval stations as follows: Fort Lafayette, N. Y. Harbor, Schedule 6656—one duplex fire pump (500 gal. per minute), Underwriter type; Schedule 6655—1400 ft. four-conductor, 2400-volt submarine cable. Brooklyn, N. Y., Schedule 6652—600 tubes, 4-in. outside diameter, 18 ft. long, 134 in. thick; Schedule 6664—1500 ft. rubber insulated wire, lead-covered, single and duplex, 26,-300 circ. mil; Schedule 6657-5000 ft. single-conductor wire, 9000 circ. mil, leaded, and armored and soft steel. Newport, R. I., Schedule 6654—30,000 unannealed brass tubes; Schedule 6655—10,000 ft. iridium-platinum wire, 2 mils diameter; Schedule 6665—6200 ft. insulated and lead-covered, 500,000 and 212,000-circ. mil cable, 3000 ft. lead-covered, insulated paper telephone cable (50 pair and 25 pair). Norfolk, Va., Schedule 6663—three 1-ton and three 0.5-ton self-contained electric hoists; Schedule 6664—8000 ft. triplex-covered, weather-proof, solid 52,600-circ. mil copper wire. Philadelphia, Pa., Schedule 6658—telephone switchboard, front connection type of ship's service, miscellaneous telephones and spare parts. Bids will also be received until May 12 as follows: Brooklyn, N. Y., Schedule 6675—four ammeters and three voltmeters, portable and 100 wave-meters; Schedule 6673—miscellaneous material for Curtis turbines; Schedule 6682—miscellaneous steel tubing. Philadelphia, Pa., Schedule 6669—six rigid frogs and six split switches (miscellaneous). Norfolk, Va., Schedule 6674—58,300 lb. seamless-drawn condenser tubes, composition "A," ⅝-in. outside diameter, 13 ft. 2¼ in. long. Bids will also be received until May 26 for one Universal motor-driven woodworker, to be delivered f.o.b. Rixey, Col., as per Schedule 6686.

Bids will be received until June 2 for 5000 electric primers (3-ft. wires), to be delivered at Pearl Harbor, Hawaii, as per Schedule 6660. Application for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

ALMA, MICH.—The Alma Illg. Engineering Co. has obtained franchises through the townships of Sumner and Seville in Gratiot County. The company will furnish electricity for lamps and motors in Elwell, Riverdale, Sumner, Elm Hall and Vestaburg.

DETROIT, MICH.—The contract for the electrical work in the new Statler Hotel, which will be 18 stories high, has been awarded to L. K. Comstock, of Chicago, Ill.

DETROIT, MICH.—The Edison Illg. Co., of Detroit, has awarded the general contract for the construction of its new power plant, to be erected at the junction of Connor's Creek and the river, to the A. A. Albrecht Co., of Detroit. This plant is intended to duplicate the one in Delray.

MACKINAC ISLAND, MICH.—The Municipal Wtr., Lt. & Pwr. Co., of Mackinac Island, expects to install one 200-kw Allis-Chalmers generator and engine and two General Electric switchboards in April; it also expects to install one 200-kw General Electric generator next December.

MARQUETTE, MICH.—A transmission line will be erected between Marquette and Palmer to furnish electricity in the latter town. The new line will also furnish electricity for lamps and motors for several mining locations south of Negaunee.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, 513 City Hall, Cleveland, until April 29, for lead-covered cable for the municipal lighting plant. Specifications are on file in the office of commissioner of light and heat division, 1443 East Third Street.

CLEVELAND, OHIO.—F. W. Ballard, commissioner of the lighting division, has announced that light and power service from the new municipal electric-light plant will be extended to the vicinity of Euclid Avenue and East 105th Street. With the $800,000 derived from the recent sale of bonds the lighting division is prepared to install a large portion of its distributing system. Distributing equipment is to be installed in the Fairmont heating station and the district supplied with municipal heating service is to have city light and power service. An extension will be made first to the lake front factory section near the East Fifty-third Street plant.

DAYTON, OHIO. — Preliminary steps have been taken by the Doty Mfg. Co., now located in the Callahan Power Building, for the erection of a new building, 80 ft. by 120 ft., to cost $100,000. The company manufactures vacuum sweepers. Walter G. Doty is president and manager.

HAMDEN, OHIO.—The village of Hamden is negotiating with the town of Wellston to secure electricity from the municipal electric plant in Wellston. The franchise of the Hocking Valley Ry. Co., which now furnishes electrical service here, will soon expire.

HOWENSTINE, OHIO.—Homer V. Briggle, general manager of the O. C. Barber Mining & Fertilizer Co., of Howenstine, has announced plans for the construction of an electric power plant here, to cost about $1,000,000, to furnish electricity to towns in this vicinity. The company also contemplates the construction of a new hydrate plant, at a cost of $100,000.

LANCASTER, OHIO.—The Board of County Commissioners has granted the Ohio Ry. & Lt. Co. a franchise to erect a transmission line connecting the Lancaster with the Newark plant. The entire right-of-way, it is understood, has been secured.

LOGAN, OHIO.—The Ohio Lt. & Pwr. Co. has secured the right-of-way from Logan to New Straitsville, a distance of 18 miles, for a high-tension transmission line.

LONDON, OHIO.—Bids will be received by J. W. Byers, village clerk, until May 12, for equipment for cluster lamps to be erected on North Main Street.

LORAIN, OHIO.—The Lorain, Ashland & Southern Ry. Co., it is reported, expects to have its railway between Custaloga and Lorain completed within two months. Approximately 22 miles of track are yet to be laid. Plans have not yet been completed for the construction of the power house. A temporary arrangement has been made with the Cleveland, Southwestern & Columbus Ry. Co., of Cleveland, to furnish energy. J. Palmer Ramsey is chief engineer of Lorain, Ashland & Southern Ry. Co.

MASSILLON, OHIO.—Within the next two months the Massillon El. & Gas Co. expects to purchase two 650-hp boilers, one 2000-kw and one 1500-kw turbine, condensers for above units and switchboard equipment for same; also within the next 10 months to erect a 200-ft. smokestack and rebuild boiler room. R. A. Brooks is general manager.

MILAN, OHIO.—The Lake Shore El. Ry. Co., of Cleveland, has submitted a proposition to the Village Council to furnish electricity in this village at a low rate. The service is now supplied by a municipal plant.

NEW BREMEN, OHIO.—Bids will be received at the office of the clerk of board of trustees of public affairs until May 20 for the purchase of the following equipment: One De Laval steam turbine, driving two 37½-kw, three-phase, 60-cycle Western Electric generators, directly connected, with condenser and centrifugal pump complete, and exciter for same; one 50-kw Westinghouse three-phase, 60-cycle generator; one belt tightener, one 60-in. by 12-in. wood pulley. For details see proposal columns. Ferd W. Rabe is president of board of trustees.

PORTSMOUTH, OHIO.—The Ohio Public Utilities Commission has authorized the Portsmouth St. R. R. & Lt. Co. to issue $250,000 in capital stock and $500,000 in bonds, the proceeds to be used to extend its system to Ironton and for new construction in Portsmouth.

SYCAMORE, OHIO. — The municipal electric-light plant has been closed by the orders of the state boiler inspector, owing to defective boilers. This action has left the entire town without electrical service. It is understood that it will be necessary to call a special election to authorize bonds to make the necessary improvements.

TOLEDO, OHIO.—The Willys-Overland Co. is constructing a building, 401 ft. by 430 ft., adding 28 acres floor space to its factory. A large power plant will be erected in connection with this addition.

TOLEDO, OHIO.—A resolution has been presented to the City Council recommending municipal ownership of the street railway, power plants, heating and lighting systems and all machinery and equipment necessary to operate these utilities. The resolution provides for submitting the question of municipal ownership to the voters.

TRUMAN, OHIO.—The installation of a municipal electric-light plant in Truman, to cost about $4,000, is reported to be under consideration.

BURGIN, KY.—The installation of an electric-light plant and ice factory in Burgin is under consideration. P. H. DeBaun, of Perryville, is interested in the project.

FULTON, KY.—The Fulton El. Lt. & Pwr. Co. is contemplating making some improvements to its plant during the coming year.

SEBREE, KY.—The Warren Milling Co., it is reported, contemplates remodeling its electric-light plant and mill. H. G. Warren is president.

EAST GARY, IND.—A petition has been filed with the Public Service Commission by the city of East Gary, asking permission to issue $9,000 in bonds to build a municipal electric-light plant.

CHICAGO, ILL.—Bids will be received by Ray Palmer, commissioner of gas and electricity, Room 614, City Hall, Chicago, until April 25, for furnishing the Department of Gas and Electricity, city of Chicago, with 30,000 ft. No. 6 B. & S. G. rubber-covered, lead-incased electric-light cable and 50 to 115 keyless-door fire-alarm signal boxes. Proposals to be made out on blanks furnished by the commissioner.

CHICAGO, ILL.—Bids will be received by the Armory Commission, Room 648, 29 South LaSalle Street, Chicago, until May 8, for the construction of an armory for the Eighth Infantry, Illinois National Guard, at Forest Avenue, near East Thirty-fifth Street. Bids will be received separately on the general work and plumbing and heating. Plans and specifications may be obtained at the office of James B. Dibelka, supervising architect of the State of Illinois, upon deposit of $25. On a return of plans $20 will be refunded.

DU QUOIN, ILL.—The Du Quoin Utility Co. is now erecting new transmission lines and changing its system from single to three-phase for power purposes. The company has purchased a turbine and generator and material for distribution system. J. Naumer is superintendent.

FARMER CITY, ILL.—Within the next two months the electric light commission expects to purchase 40 single-lamp boulevard posts. Fred H. Reed is city clerk.

FISHER, ILL.—Within the next few months the town of Fisher expects to purchase a small amount of wire and some meters. A. L. Baker is engineer and manager.

GENOA, ILL.—A contract has been awarded to the Illinois Northern Utilities Co., for the installation of an ornamental street-lighting system in the business district, consisting of 60 ornamental lamps to be placed on cement posts. The cost of the system is estimated at about $1,800, the cost to be paid by the merchants and the maintenance by the city.

PEORIA, ILL.—The officials of the Illinois Trac. System have awarded contract for the construction of the new depot transfer station and public office in Peoria, to cost about $300,000.

PEORIA, ILL.—Within the next two months the Central Illinois Lt. Co., of Peoria, expects to erect 8 miles of three-phase transmission lines from Farmington to Elmwood, material for which has been purchased. R. S. Wallace is vice-president.

GOOD THUNDER, MINN.—The Good Thunder El. Co., recently incorporated with a capital stock of $10,000, has been granted a 30-year franchise to furnish electricity here. Plans and estimates for the proposed plant are being prepared by B. H. Grover, consulting engineer. All machinery and equipment to be purchased. F. H. Griffin is secretary.

HENNING, MINN.—The installation of a municipal electric-light plant in Henning is under consideration. A committee of three has been appointed to make investigations of plants in other towns.

HILLS, MINN.—Within the next three months the village of Hills expects to erect a power house and to purchase one 50-hp oil engine and a 37½-kva, three-phase, 2300-volt generator and switchboard, pole-line material, transformers and street-lighting fixtures; also within the next two weeks a complete line of wiring supplies, heating devices and meters. V. A. Hoar is superintendent and purchasing agent.

LAKE PARK, MINN.—We are informed that a municipal electric-light plant has already been installed in Lake Park. Reported in the issue of April 4 to be considering the installation of a municipal plant.

LAMBERTON, MINN.—The Village Council has granted a 10-year franchise for the installation of an electric-light plant in Lamberton. Ornamental lamps will be installed in the business district. Fred Griffin is interested in the project.

NEW ULM, MINN.—Representatives of the Luce El. Co., it is reported, have submitted a proposition to the Commercial Club, offering to extend its transmission lines to New Ulm.

ROUND LAKE, MINN.—Estimates have been submitted by Earl Jackson, consulting engineer, of St. Paul, placing the cost of a municipal electric-light plant at $9,000. Energy may be transmitted from Worthington via Bigelow.

VERGAS, MINN.—The installation of an electric-light plant is reported to be under consideration. J. E. King, of Frazee, is interested.

BUCK GROVE, IA.—Messrs. Quarthamer & Schoening, who have a franchise to furnish electricity in Buck Grove, it is reported, have begun work on construction of plant.

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion Tel. Co. will soon begin work on the installation of a tile-conduit system in Cedar Rapids, to cost about $85,000.

DES MOINES, IA.—Plans are being considered by the Des Moines El. Co. for the installation of a central heating plant. The proposed initial plant would serve the West Des Moines business district.

EARLHAM, IA.—Bids, it is understood, will soon be asked for equipment for the municipal electric-light plant.

EMMETSBURG, IA.—The installation of a municipal electric-light plant in Emmetsburg is under consideration.

HAMPTON, IA.—The Hampton El. Lt. & Pwr. Co. has applied for a new franchise in Hampton. The company, it is reported, contemplates enlarging and improving its plant here with a view of furnishing electricity in all adjoining towns.

KEOKUK, IA.—The Mississippi River Pwr. Co., of Keokuk, has applied to the Public Utilities Commission of Illinois for authority to issue debenture bonds to the amount of $4,000,000 and also $200,000 in first mortgage bonds.

PATON, IA.—At a special election held April 9 the proposal to issue bonds for the installation of an electric-lighting system was carried.

PIERSON, IA.—At an election held recently the proposal to install an electric-light system in Pierson was carried.

RADCLIFFE, IA.—The Ellsworth Milling Co., of Ellsworth, has submitted a proposal to the town of Radcliffe offering to furnish electricity for lighting the town.

GILMAN CITY, MO.—The City Council has engaged E. B. Murray and L. C. Hamilton, associate engineers, Missouri Savings Bank Building, Kansas City, to prepare plans for the installation of a municipal electric-light plant in Gilman City, to cost about $8,000. Contracts, it is understood, will be awarded about May 1.

HAYTI, MO.—The Hayti Lt. Co. will install another generating unit in its power plant within the next 60 days. The company has not yet decided upon the machinery to be installed. A. B. Cortright is general manager.

HUNNEWELL, MO.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-lighting system.

MACON, MO.—The city of Macon is negotiating with the Bevier El. Co., of Bevier, and the town of Callao to furnish electricity. The plan provides for the erection of transmission line and equipment, including transformers, wire, poles, etc., for 9 miles of transmission line, by the parties to be supplied. The Bevier El. Co. has a small gas-engine equipment and the town of Callao is establishing a new system. C. F. Thudium, superintendent of the municipal electric-light plant, will have charge of the engineering work.

AVON, S. D.—The Council has granted John Burbeck a franchise to install an electric light plant in Avon.

BRUNING, NEB.—Bids will be received by G. G. Bruckert, village clerk, until May 12 for the construction of an electric-light system, to cost $7,308, and water-works system at $11,778. Grant & Fulton, of Lincoln, are engineers.

CREIGHTON, NEB.—I. J. Jamison & Sons, of Malmo, and Robert Fulton, of Lincoln, who recently purchased the property of the Creighton Gas & El. Lt. & Pwr. Co., it is reported, contemplate improvements to the plant, to cost about $5,000.

HOLSTEIN, NEB.—Daniel Essinger, of Holstein, has applied to the Village Council for a franchise to install and operate an electric-light plant. We are informed that the village does not contemplate the installation of a municipal plant, as reported in the issue of April 11. C. L. Stanley is village clerk.

HOOPER, NEB.—The local electric-light plant is reported to have been purchased by M. E. Shipley, of Hooper.

MARYSVILLE, KAN.—Plans are being considered by Charles O. Beardslee and E. G. Ward, who have established offices in Marysville, for developing the water-power of Big Blue River. The plan provides for the construction of four dams and to develop about 6000 hp to be transmitted to cities and towns within a radius of 100 miles for lamps and motors.

PRATT, KAN.—At an election held recently the proposal to install a municipal electric-light plant in Platt was carried.

SUMMERFIELD, KAN.—Plans are being prepared by E. B. Murray and L. C. Hamilton, associate engineers, Missouri Savings Bank Building, Kansas City, Mo., for the installation of a municipal electric-lighting system, to cost about $12,000.

WELLSVILLE, KAN.—The Wellsville Lt. & Pwr. Co. is planning to build an electric power plant, contracts for which will be awarded in about 30 days. The equipment will include one 75-kw, three-phase, 60-cycle, 2300-volt generator (belted), one generator switchboard panel, one series switchboard panel, three ammeters, one voltmeter, one service ammeter, one 2300-volt automatic oil switch, one totalizing wattmeter, 5-kw, 2300-volt, service regulator and transformer, about 125 5-amp ammeters, 6.6-amp series tungsten lamps and about 4½ miles of distribution lines. The company will carry a complete line of electrical supplies. The street-lighting system will consist of sixty 100-watt series street lamps. A 6-ton ice plant will be operated in connection with the electric plant. C. A. Smith is proprietor of the plant.

WESKAN, KAN.—A power plant will be erected near Weskan by the Kansas State Irrigation Board to furnish power for irrigating purposes. R. P. Hines, of Topeka, is chairman of board.

Southern States

CHARLOTTE, N. C.—The Southern Pwr. Co., of Charlotte, it is reported, has organized a company to construct an electro-chemical fertilizer plant, utilizing 10,000 electrical hp.

ELKIN, N. C.—Plans are being considered to construct a hydroelectric power plant at Carters Falls, 3 miles west of Elkin, to cost about $20,000. The work will include a diverting dam, power house, etc., to develop 200 hp for transmission to Elkin and Jonesville. A company will probably be organized under the name of the Carters Falls Power Co. to operate the plant. The J. B. McCrary Co., of Atlanta, Ga., is engineer.

ALLENDALE, S. C.—At an election held recently the proposal to issue $65,000 in bonds for the installation of an electric-lighting, water and sewer system was carried.

COLUMBIA, S. C.—The Columbia Ry., Gas & El. Co., it is reported, is planning to build an addition to substation at Washington and Assembly Streets, at a cost of about $2,000; will install switchboard and transformers.

EHRHARDT, S. C.—The town of Ehrhardt, it is reported, has awarded contract for the installation of an electric-light plant.

SPARTANBURG, S. C.—The City Council is considering the question of installing an ornamental street-lighting system in the business district. The present plans provide for the installation of 88 arc lamps to take the place of 25 arc lamps under the present system.

WILLISTON, S. C.—Bids will be received by the Commissioners of Public Works until May 1 for the installation of an electric-light plant. L. S. Mellichamp is secretary.

ACWORTH, GA.—The managers of the municipal electric-light plant expect to purchase some lightning arresters soon.

ALBANY, GA.—The Albany Pwr. & Mfg. Co. expects to erect within the next three months 10 miles of 6600-volt, single-phase No. 4 copper wire transmission lines and to purchase one 50-kw, 2300/6600-volt transformer, one 20-kw and one 5-kw, 6600/115-volt transformer; also to purchase within the next six months one 750-kw, three-phase, 60-cycle, 2300-volt turbo-generator complete with condensing equipment. E. S. Killebrew is superintendent.

COLUMBUS, GA.—Within the next six months the Columbus Pwr. Co. expects to purchase one 500-kw generator and waterwheel (three-phase, 60-cycle, 11,000 volts); this will be a horizontal unit working under a head of 70 ft.; also to purchase one 100-kw, 60-hp, two-phase, 2200-volt motor-driven exciter and two 800-kw, 60-cycle, 11,000/2200-volt transformers. John S. Bleecker is manager.

MACON, GA.—A resolution authorizing the city of Macon to issue bonds for the installation of a municipal electric-light plant has been introduced into the City Council.

METTER, GA.—The Metter Co-operative Lt. & Pwr. Co., recently incorporated, has installed a small plant to light the business district of Metter. G. L. Williams is secretary and treasurer.

PELHAM, GA.—At an election held April 15 the proposal to issue $4,000 in bonds for extension to the lighting and water systems was carried.

BARTOW, FLA.—Within the next three months the city of Bartow expects to build a new brick power house and to purchase within the next 30 days a 250-hp boiler, one 175-kw, three-phase, 2300-volt alternator, a 225-hp single automatic engine, a feed-water heater, boiler-feed pump, etc. D. E. Bivins is manager.

BUNNELL, FLA.—Within the next six months Lambert & Moody, owners of the local electric-light plant, except to erect a new power house and substation and to purchase generators, engines, waterwheels, switches, protective devices, waterwheel governors, pumps, condensers, lightning arresters, transformers, insulators, arc lamps, incandescent lamps, posts, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc.

JOHNSON CITY, TENN.—John W. Hunter, of Johnson City, who is making arrangements to furnish electrical service here and also to furnish electricity to operate the street railway system in Johnson City, will either purchase the local plant or build a new one.

BENTONVILLE, ARK.—Within the next six months the electric light and water works commissioners expect to erect 5 miles of transmission line and to purchase pumps and switching equipment for plant and also motors and complete pumping outfit. George A. Johnson is superintendent.

HARRISON, ARK.—The electric-light plant of the Harrison El. Lt. & Ice Co. has been purchased by a syndicate of Eastern capitalists headed by George D. Locke, of Rogers. The company has been reorganized under the name of the Harrison Gas & El. Co. and the capital stock increased to $100,000. Work will begin at once on the construction of a new electric plant on a new site. The present plant will be abandoned when the new plant is completed. The ice plant has been retained by R. M. Fellows, former owner of the light and ice plant, who will expend $25,000 for new equipment. Mr. Locke has been elected president of the gas and electric company.

HUNTINGTON, ARK.—The Coal & Gas Belt El. Co., of Huntington, expects to purchase within the next 10 months one 350-kw turbine, one 350-hp water-tube boiler and one 10-ton ice tank. G. W. Skow is general manager.

MELVILLE, LA.—A special election has been called for May 2 to submit the proposal to issue $15,000 in bonds for the installation of a municipal electric-light plant. Anderson Offutt, of New Orleans, has been engaged as electrical engineer.

ARANSAS PASS, TEX.—Bids will be received by the town of Aransas Pass until May 5 for equipment for electric-light plant and water-works system as follows: One 45-hp oil engine, one 25-hp oil engine, one 35-kva, three-phase, 60-cycle generator, one 18-kva generator, one two-stage centrifugal pump (500 gal. per minute capacity), one triplex pump (300 gal. per minute capacity), one switchboard, pole-line material, cast-iron pipe and fittings (class B), standard fire hydrants, water-gate valves, one tank and tower, 60,000 gal. capacity (120 ft. to bottom of tank); also cement, brick, sand and gravel. Specifications may be obtained from M. Griffin O'Neil & Sons, Dallas, Tex. Jesse J. Todd is Mayor.

CARLSBAD, TEX.—Plans are being prepared for the installation of an electric-light plant at the Texas Tuberculosis Sanitarium, at a cost of $9,000.

CUERO, TEX.—The Cuero Lt. & Pwr. Co. has been granted permission by the State of Texas to build dams on the Guadalupe River for the development of electrical power. The contract is for a period of 50 years. The company already has one dam and hydroelectric plant, representing an investment of $240,000, and it proposes to construct two additional dams and plant, at a cost of $160,000.

NAPLES, TEX.—The Seven Cities Co., of St. Louis, Mo., is installing an electric-light plant and ice factory in Naples, and extending its transmission lines to Omaha and New Boston, Tex. The company is planning to build a large hydroelectric plant in Russellville, Ark.

SHERMAN, TEX.—The Texas Lt. & Pwr. Co. contemplates improvements to its local plant, at a cost of about $18,000.

Pacific States

REPUBLIC, WASH.—The Republic Lt. & Pwr. Co., it is reported, is contemplating repairs to its flumes, power plant, etc., at once.

SEATTLE, WASH.—Application has been made to the Commissioners of King County by Stephen J. Lynden, president of the Vashon El. Co., for a franchise to construct and operate telephone, electric transmission lines and electric railway on Vashon and Maury Islands.

SOUTH BEND, WASH.—The Willapa Pwr. Co., recently incorporated with a capital stock of $1,000,000, it is reported, contemplates developing several water-power sites in Pacific County. Franchises to operate in several nearby cities have been granted. William Summers, Lane Summers, H. R. Harriman and Frank MacKean, all of Seattle, and Frank Balcom, of Grand View, are incorporators. The headquarters of the company are located in the White Building, Seattle.

SPOKANE, WASH.—The Spokane Valley Pwr. Co., it is reported, is contemplating the reconstruction of entire power system here, at a cost of about $800,000. The company proposes to utilize a power site below Spokane: it is estimated that 20,000 hp can be developed. J. D. Sherwood is president.

TACOMA, WASH.—The Tacoma Ry. & Pwr. Co. expects to purchase within the next three months steel trolley poles for 27 blocks in the business section of the city. Orders have been placed by the company with the General Electric Co. for a complete new relay protective system for high-tension switches, with 60-amp-hr., 110-volt storage battery, from the Electric Storage Battery Co., of Philadelphia, Pa., and has also purchased one 50,000-volt and one 25,000-volt aluminum lightning arrester.

COVINA, CAL.—We are informed that bids will not be received until some time in May (date not yet determined) for material for the proposed ornamental street-lighting system. Reported in the issue of March 14 that bids would be received about April 15. Floyd G. Dessery, Central Building, Los Angeles, is engineer.

NEWPORT BEACH, CAL.—Contracts have been awarded for the installation of an ornamental street-lighting system. The plans provide for the erection of 150 fluted pressed-steel posts, equipped with one 100-cp lamp, and the installation of metal underground conduits, to cost about $23,000. The work will be done under the supervision of W. T. Weber, city engineer.

REDLANDS, CAL.—The Coachella Valley Ice & El. Co., of Redlands, has applied to the State Railroad Commission for a certificate of public convenience and necessity authorizing it to do business in Riverside and Imperial Counties.

SAN DIEGO, CAL.—The construction of a dam, reservoir and power plant on Boulder Creek as an adjunct to the Cuyamaca Wtr. Co.'s system has been announced by Col. E. Fletcher and James A. Murray. The dam will be 40 ft. high, 455 ft. long at the top and 90 ft. wide at the bottom and will have a capacity of 2,200,000 gal.; a conduit 4 miles long will lead from the reservoir. The power plant will cost approximately $247,000. It is proposed to furnish water for irrigating about 4000 acres and for other purposes in El Cajon Valley, La Mesa and East San Diego.

SANTA MARIA, CAL.—The Midland Counties Gas & El. Co., of Santa Maria, it is reported, is negotiating for the purchase of the Lompoc Lt. & Pwr. Co., of Lompoc. The plan contemplates not only the purchase of the Lompoc plant but also the erection of a high-tension transmission line from Santa Maria to Lompoc, via Harris station and over the Purissima grade; from Lompoc the line will be extended up the Santa Ynez River valley to Santa Ynez and thence to Los Olivos. The installation of a 2500-kw generator in the Santa Maria plant is also contemplated.

VISALIA, CAL.—The Mount Whitney Pwr. & El. Co., of Visalia, is planing to erect a substation 1 mile east of Terra Bella. The new station is one of five to be built this spring; the others will be erected at Earlimart, Goshen, Strathmore and Woodville.

NEZ PERCE, IDAHO.—The Grangeville El. Lt. & Pwr. Co., of Grangeville, it is reported, will install new transformers at Nez Perce.

MANTI, UTAH.—Orders have recently been placed by the city of Manti with the General Electric Co. for a series street-lighting system. Poles for the new lighting system have already been erected. George Brox is superintendent.

GLOBE, ARIZ.—We are informed that it will probably be three months before the proposal to establish a municipal electric plant will be submitted to the taxpayers. As yet an engineer has not been engaged. Harry C. Houser is city clerk.

PRESCOTT, ARIZ.—Surveys are being made by the Pacific Wtr. Pwr. Co., of Prescott, for the construction of three power plants on the Verde River. Two power plants are to be built on the river below a point where Fossil Creek empties into the Verde, and the other plant is to be located about 12 miles below Camp Verde. Electricity generated at the plants will be transmitted to Miami and Globe, in Gila County, a distance of about 70 miles. E. H. Meek is president.

PRESCOTT, ARIZ.—Bids will be received by the board of school trustees, District No. 1, Yavapai County (Prescott City Schools), until May 4 for construction of brick high school building and a manual arts building. Separate bids will be received for the work as follows: (A) For general contract work for the high school building and for the manual arts building, including wiring for electric-lighting and power purposes and for telephones; also to include the wrecking of present structures on premises; (B) plumbing; (C) heating and ventilating; (D) program clock system; (E) for athletic field complete. Copies of plans may be secured at the office of the board of trustees, Prescott; at the office of W. B. Barr, National Bank of Arizona Building, Phoenix, and at the office of William J. Bliesner, architect, 1616 Highland Avenue, Los Angeles, Cal., for which a deposit of $20 will be required, to be refunded upon return of plans.

LEWISTOWN, MONT.—Bids, it is reported, will be received by the City Council until May 11 for installation of lighting system in the business district.

SIDNEY, MONT.—The Water Users' El. Co. has been granted a franchise to furnish electricity in Sidney. The company will erect a transmission line from Enia to Sidney, a distance of 40 miles.

AGUILAR, COL.—The Aguilar Lt. & Pwr. Co. expects to erect within the next three months a pole transmission line to Lynn, a distance of about 1 mile. A. J. Arnold is manager.

AKRON, COL.—The Washington County Gas & El. Co., of Denver, has purchased equipment for a generating station at Wray and also for a 60-mile transmission line to be erected within the next three months to furnish 24-hour service in the towns of Laird, Wray, Eckley, Yuma, Otis and Akron, Col. The central unit to be installed at Wray consists of a 350-hp compound condensing steam engine and a 250-kva, three-phase, alternating-current generator and a smaller unit, consisting of a 150-hp steam engine and a 125-kva generator. The present plant furnishing electrical service in Akron will be closed and held as a reserve unit. It will require about 30 miles of line to serve the towns; for this and the transmission line about 3000 poles will be required, with necessary transformers, distribution cable, etc. George H. Sethman, of Denver, is president of the company, and W. B. Glasser is manager.

MONTROSE, COL.—Within the next three months the Montrose El. Lt. & Pwr. Co., of Montrose, expects to erect a transmission line to Delta, a distance of 23 miles. C. L. Flower is manager.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co., of Pueblo, expects to erect 6 miles of 13,000-volt transmission lines on existing poles and approximately 3 miles on new poles. W. F. Raber is vice-president and manager.

Canada

CALGARY, ALTA.—The city commissioners are considering the question of requiring all wires to be placed underground in the business section of the city.

CALGARY, ALTA.—A by-law authorizing an expenditure of $300,000 for equipping and extending the street and residence lighting systems will be submitted to the voters on May 7.

VICTORIA, B. C.—The City Council has instructed the city electrician to begin work on the construction of conduit for underground cables on Herald Street from the electric-light station to the present terminus of the conduits on Store Street.

CANSO, N. S.—The Town Council is contemplating the installation of an electric-lighting system, to cost about $15,000.

RENFREW, ONT.—The Town Council has requested the Hydro-Electric Power Commission to submit an estimate of the cost of installing a street-lighting system in Renfrew.

MONTREAL, QUE.—Preliminary plans are being prepared for an extensive hydro-electric development for the Lachine Rapids Pwr. Co. It is proposed to develop power on the north and south sides of Heron Island in the center of the Lachine Rapids.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until May 8 for motors and centrifugal pumps, float switches, electric cables, sheet copper, sheet brass, bronze bars, brass tubing, steel wire, etc. Blanks and general information pertaining to this circular (No. 845) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

LOS ANGELES, CAL.—The Midland Counties Pub. Ser. Corpn., recently incorporated with a capital stock of $2,000,000 by William Kerckhoff, A. C. Balch, Kaspar E. Cohen, A. Haas, A. G. Wishon and A. E. Wishon, proposes to furnish electricity for lamps and motors in the Santa Ynez valley, the northern end of the county and all of San Luis Obispo County. The company has acquired the power plants at Santa Maria, San Luis Abispo, Lompoc and other points, and plans for immediate extensions are being made. The company is a subsidiary of the San Joaquin Lt. & Pwr. Co.

COLUMBUS, MISS.—The Mississippi El. Co. has been incorporated with a capital stock of $1,000,000 by Charles F. Herrod, F. W. Crosby, Battle Bell and others. The company proposes to build electric power plants.

BARTLESVILLE, OKLA.—The Hominy Ice, Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by Harry A. Cushing, D. B. Mason and F. M. Overless, of Bartlesville.

DALLAS, TEX.—The Northern Texas Utilities Co., of Dallas, has been incorporated with a capital stock of $500,000 to generate and distribute electricity and gas; supply water for domestic and power purposes and also to manufacture ice. The company is authorized to do business in the counties of Dallas, Parker, Comanche, Rockwell, Montague, Wise, Panola, Bosque, Hunt, Clay and Collins. The incorporators are Hiram Grosman, W. C. Woodlief and W. T. Heninger, all of Dallas.

ST. JEAN CHRYSOSTOME, LEVIS, QUE.—The Canada Lt. & Pwr. Co. has been incorporated with a capital stock of $140,000 by A. Jodoin, L. Gagne and J. E. Vincent.

ST. PIE, QUE., CAN.—The Bagot El. Co. has been incorporated with a capital stock of $99,000 by J. A. Bourbeau, J. T. Gazelle and A. M. Morin.

UPTON, QUE., CAN.—The Upton El. Co. has been incorporated with a capital stock of $99,000 by J. A. Bourbeau, G. W. Piche and R. Loiselle.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 14, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,092,849. ROTOR CONSTRUCTION FOR INDUCTION MOTORS; J. D. Nies, St. Charles, Ill. App. filed Feb. 15, 1912. Conductor bars thrown out by centrifugal force into engagement with short-circuiting rings.

1,092,878. THERAPEUTIC ELECTRIC APPARATUS; R. H. Wappler, New York, N. Y. App. filed Aug. 12, 1913. For effecting a rhythmic swelling of the current.

1,092,880. RHEOSTAT; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 2, 1912. Disk type theater dimmer.

1,092,891. TROLLEY SWITCH; A. Bevan, Providence, R. I. App. filed March 4, 1910. Actuated by trolley wheel to control signal circuits.

1,092,918. SIGNAL DEVICE; D. G. Knittel, Pittsburgh, Pa. App. filed Jan. 28, 1913. For sending signals from police or fire-alarm boxes to a central station.

1,092,919. SIGNAL TRANSMITTER; D. G. Knittel and W. J. Davis, Pittsburgh, Pa. App. filed March 19, 1913. For transmitting variable codes from police reporting boxes to a central station.

1,092,952. COMPRESSION RHEOSTAT; P. J. Ray, Lakewood, Ohio. App. filed June 21, 1913. Formation of air-gaps prevented when elements are not under compression.

1,092,956. MEANS FOR REDUCING REFLECTION LOSSES IN DUPLEX CIRCUITS; T. Shaw, Hackensack, N. J. App. filed Feb. 28, 1913. Applicable as a phantom circuit.

1,092,957. MEANS FOR REDUCING REFLECTION LOSSES IN PHANTOM CIRCUITS; T. Shaw, Hackensack, N. J. App. filed Feb. 28, 1913. Reflection-reducing transformer.

1,092,964. COMBINED JACK AND DROP; R. M. DeVignier, Hollis Terrace, N. Y. App. filed Dec. 27, 1911. Readily assembled self-restoring jack and drop construction.

1,092,969. AUTOMATIC ELECTROMAGNETIC SWITCH; C. Benton, San Francisco, Cal. App. filed June 12, 1912. For keeping one or more signal lights burning at all times.

1,092,977. PRINTING CONTROLLED ELECTRIC SIGN; M. Compos, Mobile, Ala. App. filed Aug. 16, 1911. Perforated stencil cards give letters or designs desired.

1,092,985. APPLIANCE FOR CLEANING TARNISHED METALS; H. M. Fetters, Laporte, Ind. App. filed Dec. 18, 1912. Electropositive plates with electropositive filling therebetween.

1,093,003. COOKER; P. A. McCaskey, Lakewood, Ohio. App. filed July 6, 1911. After desired heat is attained, cooker operates on "fireless" principle.

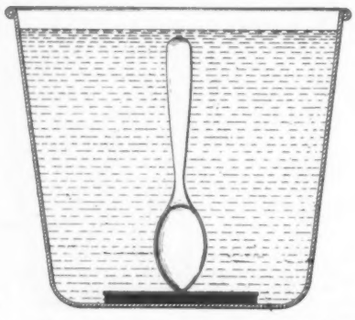
1,093,010. METHOD OF AND MEANS FOR MANUFACTURING METAL PIPE AND TUBING; E. E. Ries, New York, N. Y. App. filed Nov. 30, 1908. Electrically welded seamless metal tubing.

1,093,034. PARTY-LINE TELEPHONE SYSTEM; A. G. Cerda, Morelia, Mexico. App. filed June 26, 1908. For obtaining talking connection between branch and central station, to exclusion of other branches.

1,093,041. PARTY-LINE TELEPHONE SYSTEM; C. J. Erickson, Chicago, Ill. App. filed Nov. 15, 1906. Prevents interference between subscribers on the same line in an automatic system.

1,093,045. DYNAMO-ELECTRIC MACHINE; V. A. Fynn, London, England. App. filed JUNE 26, 1911. Continuous current, operating under varying speed in conjunction with storage battery.

1,093,051. OIL SWITCH; E. M. Hewlett and C. E. Eveleth, Schenectady, N. Y. App. filed Nov. 12, 1904. Special oil-pot construction.



1,093,236—Electrolytic Cleaning Electrode

1,093,072. HIGH-FREQUENCY DISCHARGE APPARATUS; H. W. Perkin, Glendale, Cal. App. filed Dec. 30, 1912. For ignition systems; retains high-frequency, high-tension character throughout duration of discharge.

1,093,074. ELECTRIC MOTOR; E. S. Pillsbury, St. Louis, Mo. App. filed April 11, 1911. Centrifugal switch mechanism for fan motors.

1,093,076. REMOVABLE TIP FOR THE CONTACTING ENDS OF ARMATURE SPRINGS; C. M. Proctor, Detroit, Mich. App. filed Oct. 19, 1912. Clip carrying a tip removably engaged on armature spring of electric bell.

1,093,083. DISTRIBUTION SYSTEM FOR VAPOR-ELECTRIC DEVICES; R. G. Standerwick, Lynn, Mass. App. filed May 24, 1913. Alternating-current high-pressure or "quartz" lamp.

1,093,100. MULTIPLE KEY; C. E. Beach, Binghamton, N. Y. App. filed Sept. 12, 1910. Controls plurality of signal circuits and applies one battery to each of such circuits, one after another.

1,093,113. SPARK PLUG; C. M. Conklin, Cincinnati, Ohio. App. filed Nov. 6, 1909. Heat-insulating diaphragm interposed between the parts of the insulating core which are subjected to internal and external temperature.

1,093,126. TEMPERATURE REGULATOR; W. S. Hadaway, Jr., New York, N. Y. App. filed Aug. 16, 1911. For electrical heating systems.

1,093,132. CALL SYSTEM; J. Hergesheimer, Glenside, Pa. App. filed March 5, 1913. For indicating at various points in a factory that a certain party is wanted.

1,093,137. ELECTROMAGNETIC CONTROLLING DEVICE; H. J. Keating, Chicago, Ill. App. filed Aug. 6, 1912. For imparting slow reciprocating movements to advertising and other devices.

1,093,144. PORTABLE ELECTRIC LAMP; W. J. Monaghan, Waterbury, Conn. App. filed Oct. 27, 1913. Battery held in casing so as to prevent accidental closing of circuit.

1,093,147. ELECTRICAL CONTROLLING MECHANISM; F. N. Reeves, Newark, N. J. App. filed Aug. 20, 1912. High-speed selective switching apparatus for telephone exchanges.

1,093,149. DRIVING MECHANISM FOR ELECTRICALLY PROPELLED VEHICLES; E. W. Schneider, New York, N. Y. App. filed May 31, 1910. Driving motor is made a part of the wheel which it drives.

1,093,164. REFILLABLE FUSE CARTRIDGE; G. W. Appler, Lyons, N. Y. App. filed May 6, 1913. Multiple fuse.

1,093,174. GATE-LOCKING MEANS; G. E. Ericsson, Dubois, Pa. App. filed June 15, 1912. For elevator shafts, etc.

1,093,182. ARC ELECTRODE AND PROCESS FOR MAKING IT; J. L. R. Hayden, Schenectady, N. Y. App. filed Aug. 17, 1908. Solidified fusion of magnetite, rutite chromite and fluoride of potassium.

1,093,191. IGNITER TRIP DEVICE FOR EXPLOSION ENGINES; R. Kelley, Minden City, Mich. App. filed Aug. 13, 1913. May be adjusted to advance or retard spark during the running of the engine.

1,093,195. ELECTRICAL WATER HEATER; R. R. Lockhart, Winnipeg, Manitoba, Canada. App. filed May 28, 1913. Applicable to presend-day water-heating systems.

1,093,197. METHOD OF WELDING LAMP FILAMENTS; G. F. Morrison, Newark, N. J. App. filed March 16, 1907. Magnetic means deflects the welding arc away from the filament.

1,093,207. METHOD OF MAKING WELDED CHAIN; M. B. Ryan, Bridgeport, Conn. App. filed Oct. 23, 1912. Beveled ends overset and subjected to electric welding heat with pressure.

1,093,221. CASE FOR INCANDESCENT ELECTRIC-LAMP SOCKETS; W. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed April 7, 1908. Multiple-lock socket shell.

1,093,235. TROLLEY WIRE FEED TAP INSULATOR; E. L. Alvord, Hartford, Conn. App. filed Aug. 27, 1913. Constructed so that insulator and the tap wire will not drop out of the hanger.

1,093,236. ELECTROLYTIC CLEANING ELECTRODE; T. Appleby, Philadelphia, Pa. App. filed June 24, 1913. Unitary insulating means and electropositive element.

1,093,237. ELECTRIC HEATER; G. A. Arnold, Middletown, Conn. App filed March 19, 1913. Heating coil of a size to permit its introduction through one of the holes in the induction pipe in which the insulator supports are engaged.

1,093,240. WIRELESS TELEGRAPH RECEIVER; J. G. Balsillie, Melbourne, Victoria, Australia. App. filed Feb. 10, 1914. Associated with an air wire or absorbing circuit of the looped type.

1,093,281. ELECTRIC-WELDING MACHINE; N. Macneale, Cincinnati, Ohio. App. filed Dec. 31, 1913. Die-carrying horns for spot-welding machines.

1,093,287. ELECTRIC CAP LIGHT; A. R. Neff, Los Angeles, Cal. App. filed Nov. 20, 1913. For use with commercial dry battery and combining functions of bulb holder, reflector, contact maker and light.

1,093,297. MACHINE FOR WELDING REINFORCEMENTS FOR CONCRETE; W. S. Southwick, Clinton, Mass. App. filed Oct. 26, 1911. For welding tension rods and stay wires together.

1,093,301. VIBRATOR; G. Vande, Los Angeles, Cal. App. filed June 16, 1913. Alternating-current magnet with core of double U-shaped form.

1,093,318. ELECTRICAL SPARKING DEVICE; W. J. Cunningham, Toledo, Ohio. App. filed Aug. 5, 1912. Magnet breaks contact between two electrodes.

1,093,328. ELECTRIC INDUCTION HEATER OF FURNACE; A. Helfenstein, Vienna, Austria-Hungary. App. filed June 5, 1912. Embodies a metal bath, a transformer and water-cooled poles.

1,093,368. VAPOR-ELECTRIC DEVICE; E. Weintraub and A. E. Hibschman, Lynn, Mass. App. filed Jan. 3, 1914. Mercury cathode and co-operating solid anodes located in separate arms of the envelope.

1,093,378. MOTOR-CONTROL SYSTEM; L. E. Bogen, Milwaukee, Wis. App. filed July 28, 1911. For mechanically connected motors coupled to a common load.

1,093,382. ELECTRIC FURNACE; J. W. Brown, Lakewood, Ohio. App. filed Jan. 8, 1912. Continuous type for calcination of granular carbon.

1,093,384. ROTARY ELECTROPLATING APPARATUS; C. J. Charlton, South Benfleet, England. App. filed Nov. 7, 1913. Outer rotating drum and inner perforated article-containing drum.

1,093,395. AUTOMATIC FIRE ALARM; E. A. Gehrke, Lincoln, Neb. App. filed March 22,1913. Alarm turned in thermostatically or by hand.

1,093,423. SPARK PLUG; E. Holzworth, Alliance, Ohio. App. filed April 9, 1912. Parts held together in a two-part clamping member.

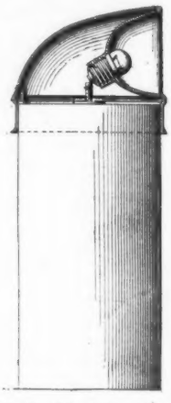
1,093,424. ADDING MACHINE; J. P. Hunter and H. Küntzler, Wilkes-Barre, Pa. App. filed Dec. 30, 1908. Automatically locked against accidental actuation when motor is not energized.

1,093,468. SEPARABLE ATTACHMENT PLUG; J. G. Peterson, Jersey City, N. J. App. filed March 31, 1913. Has screw shell with flange clamped between members of insulating base.

1,093,477. MEANS FOR PROTECTING ELECTRIC CIRCUITS FROM EXCESSIVELY HIGH DIFFERENCES OF POTENTIAL AND SIMILAR DISTURBANCES; R. Rüdenberg, Charlottenburg, Germany. App. filed March 14, 1913. Employs concentrated inductance and concentrated capacity.

1,093,479. INSULATOR; J. A. Sanford, Jr., East Liverpool, Ohio. App. filed Dec. 16, 1911. High-voltage, pin-type, built-up, nested units.

1,093,480. INSULATOR; J. A. Sanford, Jr., East Liverpool, Ohio. App. filed June 13, 1912. Built-up nested units spaced by plug disks.



1,093,287—Electric Cap Light

1,093,491. STATIC ELECTRIC ERADICATOR; F. A. Smith, Syracuse, N. Y. App. filed March 28, 1913. For printing presses.

1,093,494. ELECTRIC FURNACE FOR MEDIUM TEMPERATURES, PARTICULARLY FOR MELTING COPPER AND ITS ALLOYS; E. Stassano, Turin, Italy, and N. Petinot, Niagara Falls, N. Y. App. filed July 18, 1913. Special electrode holders and air-lock hopper.

1,093,507. TROLLEY-WHEEL GUARD; E. W. Warnick, Cuyahoga Falls, Ohio. App. filed Oct. 1, 1913. Opens automatically when passing a hanger or support.

1,093,508. STREET INDICATOR FOR CARS; F. H. Webster, Marvell, Ark. App. filed June 17, 1913. Indications carried on endless band.

1,093,510. ELECTRIC STOVE OR IRON; G. Wenzelmann, Galesburg, Ill. App. filed Nov. 11, 1913. Has asbestos heat-resisting ring running around inner face of heater cavity.

1,093,512. SHEATHED-WIRE TERMINAL; W. R. Whitney, Schenectady, N. Y. App. filed Oct. 17, 1912. Formed integral with conductor.

1,093,525. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; W. R. Binkley, New Bedford, Mass. App. filed July 22, 1905. Percentage trunking scheme.

1,093,539. MACHINE FOR COVERING ELECTRIC CONDUCTORS; E. H. Cook, Wilkes-Barre, Pa. App. filed June 5, 1908. For applying asbestos or like covering to wire.

1,093,545. STARTING MEANS FOR VAPOR-ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed Dec. 19, 1903. Bodily movable filament of carbon with one end tipped with titanium carbide.

1,093,583. ELECTRIC ELEVATOR SYSTEM; E. M. Fraser, Yonkers, N. Y. App. filed July 29, 1912. Shunt-wound motors with coupled armature shafts and rotary field structures.

1,093,592. INCINERATOR; M. H. Rice, New Rochelle, N. Y. App. filed Sept. 19, 1913. For burning garbage and wet material.